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A NEW SPECIES OF CORDANA FROM VENEZUELA

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ABSTRACT

Cordana miniumbonata anam. sp. nov., found on fallen decaying leaves of unidentified plant in an undisturbed rainforest in Venezuela, is described and illustrated. The fungus is characterized by obovoid to sub-pyriform, 3-septate, dark brown conidia with a slightly umbonate apex. A table comparing the new species with previously described species is presented.

Key words: *Cordana miniumbonata*, hyphomycetes, leaf litter, tropical fungi, Venezuela.

INTRODUCTION

The genus *Cordana* Preuss was established in 1851 with *C. pauciseptata* Preuss as the type species. The genus is characterized by the production of macronematous, mononematous, unbranched, septate, brown to pale brown conidiophores producing a plurality of conidia by sympodial proliferation. Sympodial proliferations may occur by swelling of the conidiophore apex to produce a globose swelling (*C. pauciseptata)* or by elongation of the fertile portion (*C. musae* (Zimm.) Höhnel). The conidiogenous loci are pale brown to subhyaline cylindrical denticles, sometimes very small. The conidia are obovoid, ellipsoid, pyriform, ovoid, 1-septate, sometimes the septum accompanied by a dark band, pale to dark brown.

TAXONOMY

In addition to *C. pauciseptata* sixteen additional species have been described (Table 1), not all of which are currently recognized as belonging to *Cordana*. To summarize the state of the genus, a brief nomenclature follows.

1. *Cordana abramovii* E. O. Seman & T. A. Davydkina, 1983. *Nov. Syst. niz. Rast.* 20: 115.

Table 1. Comparative table of accepted species of the genus *Cordana* Preuss.

	Conidiophores	Conidia	Substratum and distribution
C. abramovii	Dark reddish brown, 250-1000 x 10-15 µm , with swollen fertile zone 7-12 µm wide.	Broadly ellipsoid, brown, 1-septate, thick-walled, 18-31 x 12.5-15.5 µm, with a dark brown central canal at the septa.	On basidiomata of Aphyllophorales, wood and *Beilschmieda tarairi*. USSR, India and New Zealand.
C. andinopatagonica	Nodose, brown, 78-283 x 3-4 µm, base 10-14 µm wide.	Obovoid to ellipsoid, unequal, smooth-walled, subhyaline, 17-19 x 10-13 µm, 1-septate, constricted at the septa.	On *Nothofagus dombeyi*. Argentina.
C. crassa	Dark brown, pale towards the apex, smooth, up to 300 µm long, 5-9 µm wide, swollen at the base (12-14 µm)wide.	Obpyriform, 1-septate, smooth, 18-27 x 11-15 µm, with the basal cell brown to dark brown and apical cell pale to mid brown.	On wood of *Alnus*. Hungary and Great Britain.
C. ellipsoidea	Nodose, brown below, pale brown above, 50-180 x 3-4 µm, smooth at the base, verrucose towards the apex.	Ellipsoid to oblong, 1-septate, brown and dark brown, black at the septa, 7-11 x 3.5-5 µm, smooth-walled. Sessile chlamydospores in culture, ellipsoid to obovoid, dark brown, smooth, 6-9 x 4.5-5.5 µm.	From soil. Australia.
C. inaequalis	Nodose, brown to dark brown below, paler above, up to 200 µm long and 9-25 µm wide at the base, 4.5-5.5 µm wide near the apex.	Ellipsoid to ovoid, slightly denticulate at the basal scar, 1-septate, with the basal cell 2-2 $^{1}/_{2}$ times the length of the apical cell, usually with slightly darker band at the septum.	On wood. Canada.

Table1. Cont.

	Conidiophores	Conidia	Substratum and distribution
C. indica	Pale olivaceous, up to 170 μm long, 3-3.5 μm wide, serrate towards the apex.	Oval to oblong, 1-septate, constricted at septum, 11-20 x 4.5-7 μm, golden-brown, echinulate.	On dead leaves of *Casearia* sp. India.
C. jonstonii	Brown paler towards the apex, up to 400 μm long, 5-9 μm wide, swollen at the base (10-14 μm), smooth.	Broad ellipsoid, 1-septate, pale brown, 20-30 x 12-18 μm, smooth.	Causing leaf spot on *Musa sapientum*. World wide, tropical areas.
C. musae	Nodose, pale to mid brown, smooth, up to 200 μm long, 4-6 μm thick, swollen at the base 9-11μm.	Obovoid or pyriform, 1-septate, slightly constricted at the septum, subhyaline to pale brown, 11-18 x 7-10 μm, smooth.	Causing pale brown spots on *Musa* spp. Common in the tropics.
C. pauciseptata	Subulate, pale to dark brown, 60-200 x 3-6 μm, swollen at the base 4-8 μm wide, smooth.	Broad ellipsoid to ovoid, 8-12 x 5-7 μm, 1-septate, mid to dark brown, with dark band at the septum, smooth.	On wood, leaf litter, *Palm* tree and soil. Australia, Cuba, Europe, North America, Japan, India, Peru.
C. semaniae	Cylindrical, verrucose, 100-270 x 6-7μm, base up to 10 μm wide, nodose, dark brown.	Obovoid, guttulate, 21-27 x 9-15 μm, one-celled, smooth, dark brown.	On bark of *Quercus mongolica*. USSR.
C. solitaria	Nodose, stiff, 70-110 x 3.5-5 μm, smooth, brown.	Obovoid to broad ellipsoidal, 6.5-9.5 x 4.5-6.5 μm, one-celled, slightly papillate at the base, smooth, pale brown with hyaline scar. Synanamorph *Bispora*-like.	On wood. India.

2. *Cordana andinopatagonica* Gamundi & Arambarri, 1979. In Gamundi, Arambarri & Bucsinszky. *Darwiniana* 22: 198.

3. *Cordana boothii* M.B. Ellis, 1976. *More Dematiaceous Hyphomycetes.* Commonwealth Mycological Institute, Kew. p. 163.
   Synonym of *C. crassa* Tóth (Ellis and Ellis, 1986).

4. *Cordana crassa* Tóth, 1975. *Annals Hist.-nat. Mus. Nat. Hung.* 67: 32.

5. *Cordana ellipsoidea* de Hoog, 1973. *Acta Bot. Neerlandica* 22: 209.

6. *Cordana indica* Subramaniam & V. G. Rao, 1976. *Acta Bot. Indica* 4: 61.

7. *Cordana indica* S.K. Srivastava, 1983. *Indian J. Bot.* 6: 19.
   A homonym of *C. indica* (Subramoniam & V. G. Rao, 1976)

8. *Cordana inaequalis* S. Hughes, 1983. *Fungi Canadenses* 246.

9. *Cordana jonstonii* M.B.Ellis, 1971. CMI, *Mycol. Pap.* 125: 8.

10. *Cordana martini* Sarwar, 1981. In Sarwar & Parameswaran. *Indian J. Bot.* 4: 228.
    The original description lacks a Latin diagnosis, thus the species is invalid.

11. *Cordana musae* (Zimm.) Höhnel, 1923. *Zentbl. Bakt. ParasitKde.* Abt. 2 60: 7.
    Sinonym: *Scolecotrichum musae* Zimm., 1902. *Zentbl. Bakt. ParasitKde.* Abt. 2 8: 220.
    It is a pathogenic plant fungus common on *Musa* spp., (Ellis, 1971; Matsushima,1980 and 1993; Priest, 1990).

12. *Cordana oblongispora* Matsush., 1975. *Icones microfungorum a Matsushima lectorum,* Kobe, p. 39.
    Now considered a synonym of *C. ellipsoidea* de Hoog (Matsushima, 1989)

13. *Cordana pauciseptata* Preuss, 1851. *Linnaea* 24: 129.

14. *Cordana semaniae* T. A. Davydkina , V.A. Mel´nik & Novozh., 1989. In Davydkina & Mel'nik. *Mikologiya i Fitopatologiya* 23: 111.

15. *Cordana solitaria* V. Rao & S. Hoog, 1986. *Stud. Mycol.* 28: 49.

16. *Cordana triseptata* Matsush., 1975. *Icones microfungorum a Matsushima lectorum,* Kobe, p. 39.
    Transferred to *Exserticlava triseptata* (Matsush.) S. Hughes (Hughes, 1978).

17. *Cordana vasiformis* Matsush., 1975. *Icones microfungorum a Matsushima lectorum,* Kobe, p. 40.
    Transferred to *Exserticlava vasiformis* (Matsush.) S. Hughes (Hughes, 1978).

We describe here an additional species recently collected in a Venezuela rainforest which differs significantly from previously described species.

Cordana miniumbonata R. F. Castañeda, Iturr. & Guarro *anam. sp. nov.*

Figs. 1, 2

Etymology. L. *miniumbonata*,- refers to the small umbo of the conidia.

Ad fungos conidiales, hyphomycetes pertinens. Coloniae in substrato naturali effusae, pilosae, brunneae. Mycelium partim superficiale et partim in substrato immersum. Hyphae septatae, ramosae, laeves, dilute brunneae vel brunneae, 2-2.5 µm. Conidiophora macronemata, mononemata, cylindrica, leviter inflata ad basim, 2-5-septata, 90-150 x 5.5-7 µm, erecta, recta vel flexuosa, atro-brunnea vel brunnea infra, pallide brunnea supra, levia. Cellulae conidiogenae polyblasticae, terminales, sympodiales, 55-95 x 3-3.5 µm, pallide brunneae, denticulatae, cum denticulis cylindricis, 0.5-1.5 µm longis praeditae; in conidiophoris incorporatae. Conidiorum secessio schizolytica. Conidia obovata, pyriformia usque ad lata clavata, interdum leviter curvata, umbonata ad apicem, (2-) 3-septata, 16-19 x 6-7 µm, levia, sicca, solitaria in loco conidiogeno, truncata ad basim et subhyalina ad cellula basalis et atro-brunnea vel brunnea cetera.Teleomorphosis ignota.

Substratum: *In foliis caducis putridis non determinatae.* Habitat: *In sylva pluvialis,* Camino de Interpretación de la Naturaleza “Andy Fields”, Estación Rancho Grande, Parque Nacional “Henry Pittier”, 1200 m altitude, Estado de Aragua, Venezuela. Legit R.F. Castañeda et T. Iturriaga, 25. XI. 1997. Holotypus: MUCL 40700

Conidial fungi, hyphomycetes. Colonies on the natural substrate effuse, hairy, brown. Mycelium superficial and immersed. Hyphae septate, branched, smooth, pale brown to brown, 2-2.5 µm diam. Conidiophores macronematous, mononematous, cylindrical, slightly inflated at the base, 2-5-septate, 90-150 x 5.5-7 µm, erect, straight or flexuous, dark brown to brown below, pale brown above, smooth-walled. Conidiogenous cells polyblastic, terminal, sympodial, 55-95 x 3-3.5 µm, pale brown, integrated, denticulate, with cylindrical, 0.5-1.5 µm long denticles. Conidial secession schizolytic. Conidia obovoid, pyriform to broad clavate, sometimes slightly curved, umbonate at the apex, (2-) 3-septate, 16-19 x 6-7 µm, smooth-walled, dry, solitary at the conidiogenous loci, truncate at the base, with subhyaline basal cell, other cells dark brown to brown.
Teleomorph unknown.

Substrate: Fallen decaying leaves of an unidentified plant. Habitat: In undisturbed rainforest, Camino de Interpretación de la Naturaleza “Andy Fields”, Estación Rancho Grande, Parque Nacional “Henry Pittier”, 1200 m altitude, Estado de Aragua, Venezuela. Col.R.F. Castañeda and T. Iturriaga, 25. XI. 1997. Holotype: MUCL 40700.

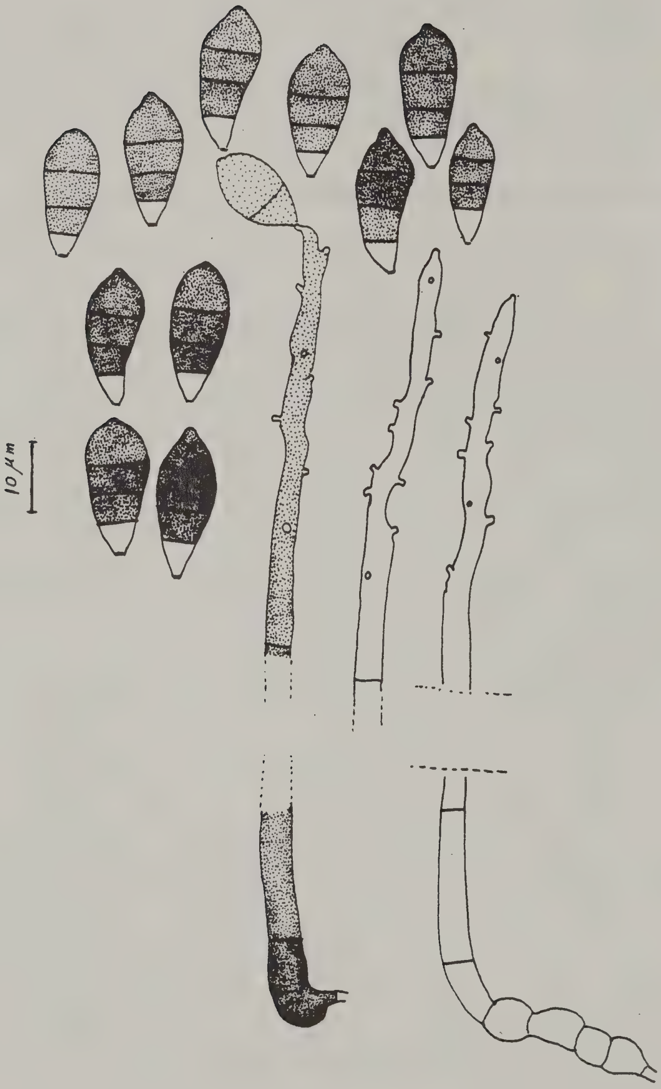

Fig. 1.- *Cordana miniumbonata* MUCL 40700.

Cordana miniumbonata can be differentiated clearly from previously described species by the conidial morphology (shape, number of septa, pigmentation) of *Cordana* (Table 1.). This species lacks the typical nodose conidiophores of *Cordana*, but the holoblastic conidium ontogeny, the denticulate conidiogenous cells and the schizolytic conidial secession are characteristics of the genus, so the description of a new genus is considered unnecessary and only a new species is therefore proposed.

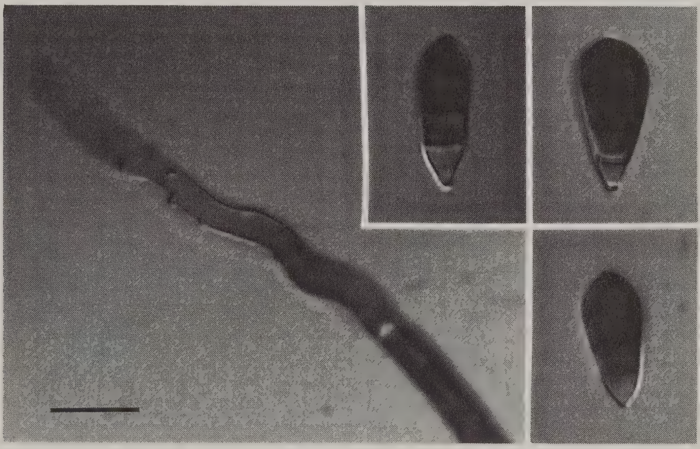

Fig. 2.- *Cordana miniumbonata* MUCL 40700, x 1440.

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REFERENCES

DAVYDKINA, T. A. and MEL´NIK V. A. (1989). Two new hyphomycetes from the genera *Cordana* and *Pyriculariopsis*. *Mikologiya i Fitopatologiya* 22, 110-113.

ELLIS, M. B. (1971). *Dematiaceous Hyphomycetes*. Kew, U.K. : CAB International Mycological Institute.

ELLIS, M. B. (1971a). Dematiaceous Hyphomycetes. X. *Mycological Papers* (CMI) 125, 1-30.

ELLIS, M. B. (1976). *More Dematiaceous Hyphomycetes*. Kew, U.K. : CAB International Mycological Institute.

ELLIS, M. B. and ELLIS, J. P.(1985). *Microfungi on land plants.* London, U.K.: Bidddles Ltd, Guildford and King's Lynn.

GAMUNDI, I. J., ARRAMBARRI and BUCSINSZKY, A. M. (1979). Micoflora de la hojarasca de *Nothofagus dombeyi*, II. *Darwiniana* 22, 189-216.

HUGHES, S. J. (1978). New Zealand Fungi 25. Miscelaneous species. *New Zealand Journal of Botany* 16: 311-370.

MATSUSHIMA, T. (1975). *Icones Microfungorum a Matsushima lectorum.*, Kobe, published by the author.

MATSUSHIMA, T. (1980). Saprophitic microfungi from Taiwan. Part 1. *Matsushima Mycological Memoirs* 1, 1-90, Kobe, published by the author.

MATSUSHIMA, T. (1989). *Matsushima Mycological Memoirs* 6, 1-100, Kobe, published by the author.

MATSUSHIMA, T. (1993). *Matsushima Mycological Memoirs* 7, 1-75, Kobe, published by the author.

PRIEST, M. J. (1990). Distribution of *Cordana* spp. on *Musa* in Australia. *Mycological Research* 94, 861-863.

RAO, V. and HOOG, G. S. DE, (1986). New or critical hyphomycetes from India. *Studies in Mycology* (CBS) 28, 1-84.

SARWAR, M. and PARAMESWARAN, T. N. (1981). Fungi associated with leaf spots of *Cymbopogon martini* Stapf. var. *motia. Indian Journal of Botany* 4, 227-228.

SEMAN, E. O. and DAVYDKINA, T. A. (1983). The genus *Cordana* Preuss in the USSR. *Novosti Sistematiki Nizshikh Rasteni* 20, 114-118.

SRIVASTAVA, S. K. (1983). A new species of *Cordana* Preuss. *Indian Journal of Botany* 6, 19-20.

SUBRAMONIAM, V. and RAO, V. G. (1976). Fungi on garbage from Bombay. *Acta Botanica Indica* 4, 58-62.

TÓTH, S. (1975). Some new microscopic fungi, III. *Annales Historico-Naturales Musei Nationalis Hungarici* 67, 30-35.

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CORTICIOID APHYLLOPHORALES (BASIDIOMYCOTA) FROM THE PATAGONIAN ANDES FORESTS OF ARGENTINA 5. SOME NEW TAXA

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Abstract

Two new species in the Corticiaceae *s.l.* are described from several substrates in the Patagonian Andes forests of southern Argentina, namely: *Athelopsis gloeocystidiata* and *Ceraceomyces austroandinum*. The new combination *Hypochniciellum oblongisporum* is proposed for an hydnoid taxon first described by G.H. Cunningham for New Zealand.

Key words: *Athelopsis*, *Ceraceomyces*, *Hypochniciellum*, *Nothofagus*.

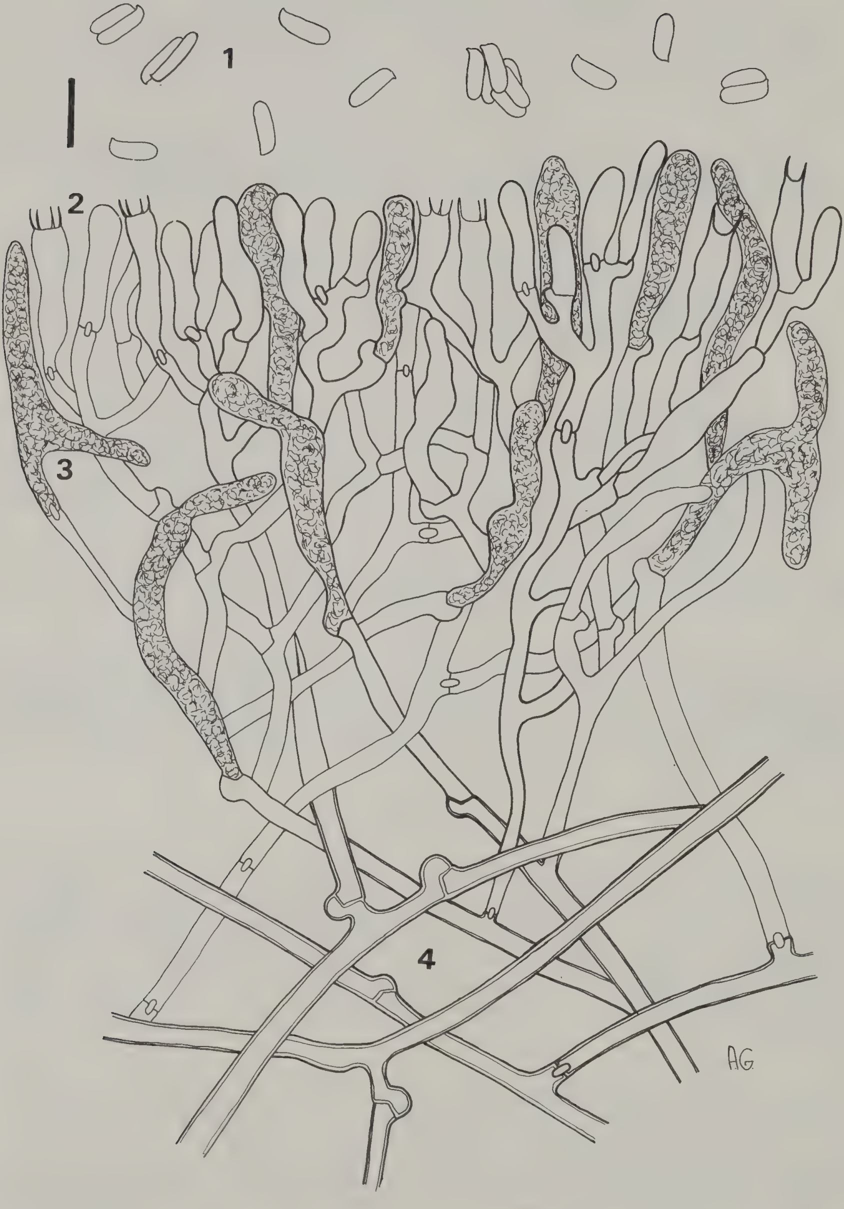
Introduction

Regular visits to the several forest types of the Subantarctic Province (Cabrera & Willink, 1980) in southern Argentina have revealed new and unexpected taxa, three of which are herein described. The methods for study were described by Greslebin & Rajchenberg (1998).

Results

Athelopsis gloeocystidiata Greslebin & Rajchenb. sp. nov. Figs. 1-4
Jacens, tenuis, laevis, luteo grisea, margine mycelialis. Hyphae generativae fibulatae. Gloeocystidia numerosa, SA-, clavata, cylindrica, constricta. Basidia clavata, pedunculata, 10-25 x 4-5 µm. Basidiosporis cylindraceis, 6-8 x 2-3 µm, tenuitunicatis, laevis, IKI-, acyanophilis. Holotypus BAFC 34529, Argentina, Chubut, Departamento Languiñeo, Lago Guacho, leg. A.Greslebin 759, 18.Apr.97.

Basidiocarp resupinate, athelioid, very thin, up to 100 µm thick. Hymenial surface smooth, yellowish grey with a slightly tint of green, greyish white (5Y 8/1, 8/2, 8/3, 7/2) or whitish grey. Margin mycelial or indistinct.
Hyphal system monomitic. Generative hyphae clamped; in the subhymenium much branched and intertwined, 2-3 µm in diam, thin-walled; in the subiculum less branched and loosely arranged, 3-4 µm in diam, thin to slightly thick-walled.



Figs. 1-4. *Athelopsis gloeocystidiata* (BAFC 34529, Holotype): vertical section through the basidiocarp. 1. Spores. 2. Basidia. 3. Gloeocystidia. 4. Subicular hyphae. Bar=10 µm.

Gloeocystidia abundant throughout the basidiocarp, sulphonegative, generally clavate but variable in shape, cylindric, with or without constrictions, branched or not, 30-60 x 4-8 µm, contents oily, yellowish, distinctly renfringent, strongly stained with cotton blue.
Basidia clavate, pedunculate or not, many with a median constriction, 10-25 x 4-5 µm, with (2-)4 sterigmata and a basal clamp.
Basidiospores cylindric, 6-8 x 2-3 µm, thin-walled, smooth, IKI-, acyanophilous, generally glued together in groups of 2, 4 or more spores.

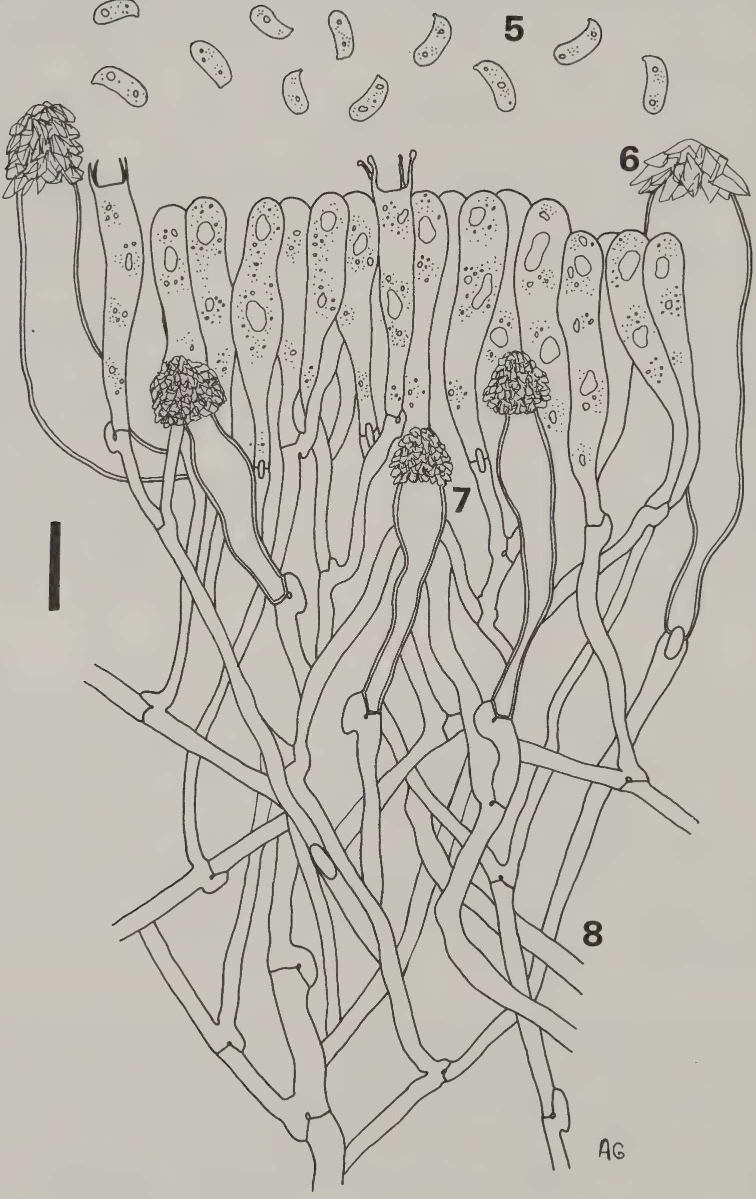
Habitat: on fallen wood and bark of *Nothofagus pumilio* (Poepp. & Endl.) Krass. ("lenga").

Material studied: ARGENTINA, CHUBUT, Departamento Languiñeo, Lago Guacho, leg. AG 759, 18.Apr.97. (BAFC 34529, Holotype) Ibid., leg. AG 760, 18.Apr.97 (duplicate DAOM 225919). Ibid., leg. AG 804, 18.Apr.97. CHUBUT, Los Alerces National Park, Lago Futalaufquen, Cerro Dedal, leg. AG 886, 30.Apr.97. Ibid., leg. AG 890, 30.Apr.97. CHUBUT, Departamento Languiñeo, Lago Engaño, leg. AG 902, 2.May.97.

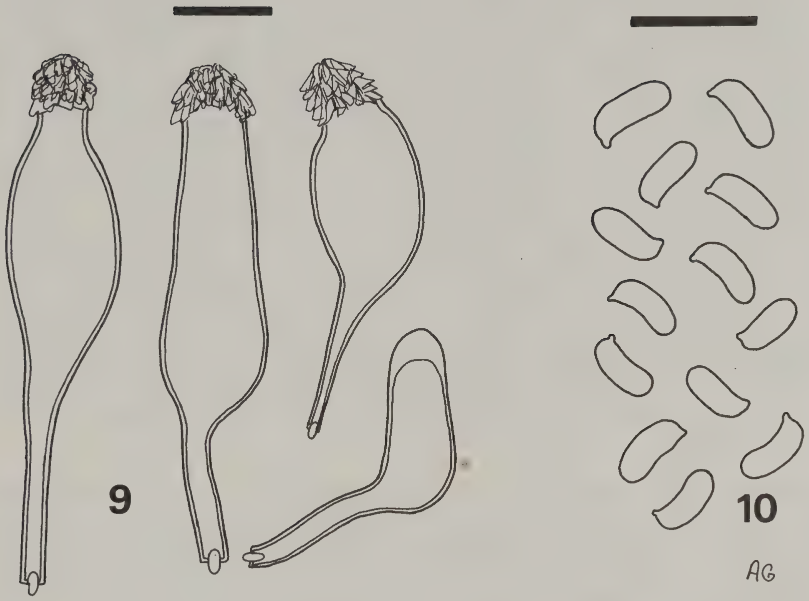
Remarks: The thin, athelioid basidiocarp and the presence of pedunculate basidia support the inclusion of the new taxon in *Athelopsis* Oberw. ex Parmasto. Its spores are similar to those in *A. glaucina* (Bourdot & Galzin) Oberw. ex Parmasto, type species of the genus. The abundant, sulphonegative gloeocystidia characterize *A. gloeocystidiata.*

Ceraceomyces austroandinum Greslebin & Rajchenb. sp. nov. Figs. 5-10
Jacens, exiguis, subpeliculoso, tenuis usque ad 140 µm crasso, laevis, subiculo gossypino vel velutino, cremeo vel leviter alutaceo, margo mycelioide vel indeterminato. Hyphae generativae fibulatae, tenuis vel leviter crassitunicatae, 2-4 µm latae. Cystidiis clavatis, incrustatis, urniformibus, cylindraceis, obtusis vel fusoideis, pedunculatis vel sessilis, 25-50-80 x 6-12 µm, parietes leviter incrassatae, in apicem 2 µm crassae. Basidia elongata clavata vel cylindracea, 23-35 x 4-6 µm, (2-)4 sterigmatibus. Basidiosporis cylindraceis vel suballantoideis, (5.5-)6-7 x 2-2.5 µm, tenuitunicatis, hyalinis. Holotypus BAFC 34530, Argentina, Río Negro, Departamento Bariloche, Río Manso Inferior, leg. M. Rajchenberg, 15.Oct.98.

Basidiocarp resupinate, pellicular, up to 140 µm thick but usually less, separable from the substrate. Hymenial surface smooth, subceraceous, sometimes porulose or densely felty, cream colored to light yellow when fresh; turning straw yellow upon drying, then cracking and showing the white, mycelioid, arachnoid or laxly felty subiculum. Margin indefinite, mycelioid, sometimes farinose or pruinose granulated due to the presence of cystidia.
Hyphal system monomitic. Generative hyphae clamped, 2-4 µm in diam, with walls thin to 0.5 µm thick; clamps more or less hemispheric or somewhat flattened, sometimes showing a small prolongation that points backwards or forwards and may be a developing branch.



Figs. 5-8. *Ceraceomyces austroandinum* (BAFC 34530, Holotype): vertical section through the basidiocarp. 5. Spores. 6. Hymenial cystidia and basidia. 7. Subhymenial cystidia. 8. Subiculum. Bar=10 µm.



Figs. 9-10. *Ceraceomyces austroandinum* (BAFC 34530, Holotype): 9. Cystidia. 10. Spores. Bar=10 µm.

Cystidia clavate, urniform, cylindric, blunt or fusoid, pedunculate or not, or with an attenuating base, variable in size within or between specimens, 25-50-80 x 6-12 µm, with slightly thickened walls, but many times up to 2 µm thick in the apex; apically encrusted with rossette-like crystals, the crystal cap of up to 25 µm in diam; the pedicel (when present) of up to 30 x 2-2.5 µm, with thin or distinct walls. Cystidia usually abundant but variable among specimens, present in the subhymenium and the hymenium; the hymenial cystidia may protrude up to 30 µm.
Basidia narrowly clavate to almost cylindric, 23-35 x 4-6, with (2-)4 sterigmata of up to 5 µm long and a basal clamp.
Basidiospores cylindric to suballantoid, (5.5-)6-7 x 2-2.5 µm, thin-walled, smooth, IKI -, with guttulae in the cytoplasm.

Habitat: On much decayed, fallen wood of *Austrocedrus chilensis* (D. Don) Flor. & Boutl. ("ciprés de la cordillera"), *N. pumilio* and *N. antarctica* (Forst.) Oerst. ("ñire"). Associated wood-rot brown, but difficult to establish with certainty that it is produced by this species.

Material studied: ARGENTINA, CHUBUT, Departamento Futaleufú, Los Cipreses, Los Rifleros river, leg. MR 11007, 18.Aug.95. Ibid., 'La 106' ranch, leg. MR 11039, 9.Oct.95. Ibid., 'Pehuén' ranch, leg. MR 11238, 6.Jun.97. Ibid., in *A. chilensis* stand owned by M. Criados near Los Cipreses, leg. MR 10879, 16.Jun.94. Ibid., leg. MR 10862, 6.Jun.94. Ibid, Trevelin, ranch owned by Mr. Beale, leg. MR 11199, 15.Nov.96. CHUBUT, Lago Puelo National Park, W arm of Lake Puelo, ca. Los Tineos stream, leg. MR 11139, 10.May.96. CHUBUT, Los Alerces National Park, ca. Lake Rivadavia, Coligual river, mixed forest of *A. chilensis* and *Nothofagus dombeyi* (Mirb.) Oerst., leg. MR 11259, 17.Jun.97. CHUBUT, Departamento Languiñeo, Lago Engaño, in pure *N. pumilio* stand, leg. AG 916, 2.May.97. CHUBUT, Lago Puelo National Park, ca. arroyo Los Tineos, on *A. chilensis*, leg. MR 11152 and 11170, 10.May.96. RÍO NEGRO, Departamento Bariloche, Río Manso inferior, on *A. chilensis*, leg MR, 15.Oct.98 (BAFC 34530, Holotype). NEUQUÉN, Los Lagos, Laguna Rosales, Lote 43, in pure *N. pumilio* stand, leg AG 1685, 17.Oct.98. Ibid., leg. AG 1686, 17.Oct.98 (BAFC 50034, duplicate DAOM 225922). RÍO NEGRO, El Bolsón, Loma del Medio, Río Azul, in front of "Doña Rosa" camping, on *A. chilensis*, leg. MR 11653, 10.Jun.98. TIERRA DEL FUEGO, Departamento Río Grande, Estancia Esperanza, in front of a Laguna Esperanza, road between Lago Chepelmut and Lago Yehuin, in pure *N. antarctica* stand, leg. AG 1492 and 1499, 24.Mar.98. TIERRA DEL FUEGO, Departamento Ushuaia, Lago Escondido, in mixed forest of *N. pumilio* and *N.betuloides*, leg. AG 1566, 23.Mar.98.

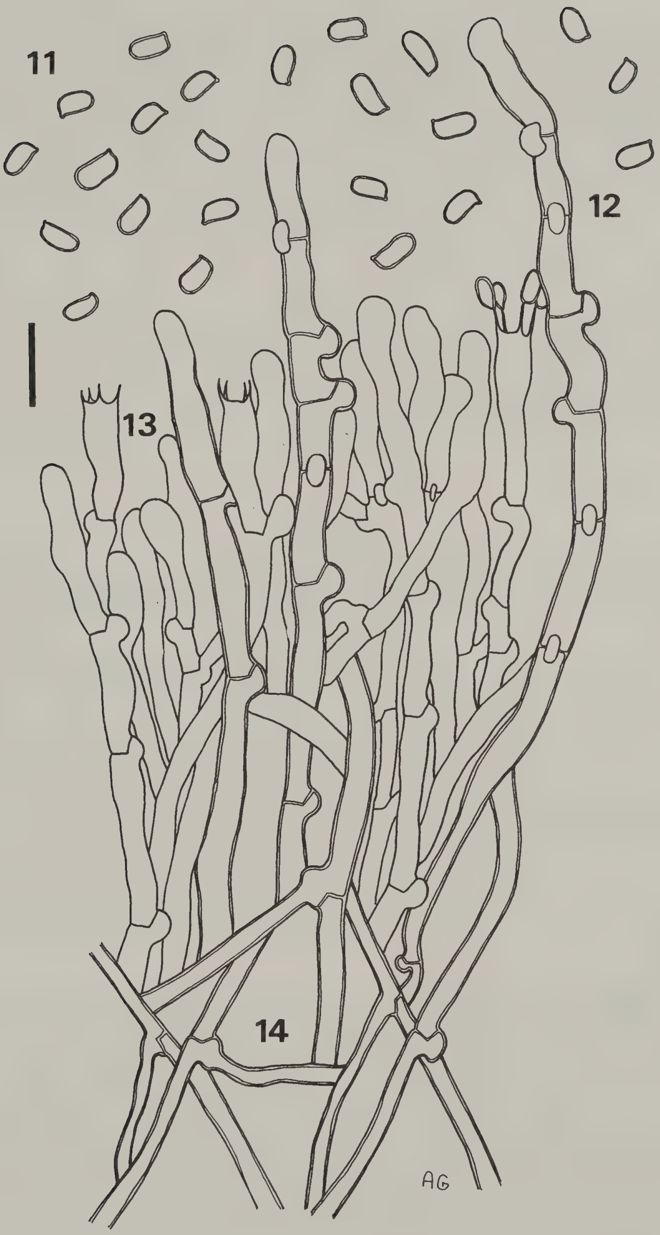
Remarks: The combination of clamped generative hyphae, narrowly clavate basidia, cystidia, small spores and a subpellicular hymenium relates this taxon to species in *Ceraceomyces* Jülich. The inclusion in *Phlebia subcretacea* group could be considered (Larsson, pers. com.), but it lacks typical features of *Phlebia* Fr. Species in *Phlebia subcretacea* group have closely adnate basidiocarps and hyphae imbedded in a gelatinous matrix (Eriksson *et al.*, 1981) while *C. austroandinum* has basidiocarps detachable from substrate, with loosely intertwined subicular hyphae, and lacks a gelatinous matrix.

Hypochniciellum oblongisporum (G.H. Cunn.) Greslebin & Rajchenb. comb. nov. Figs. 11-16

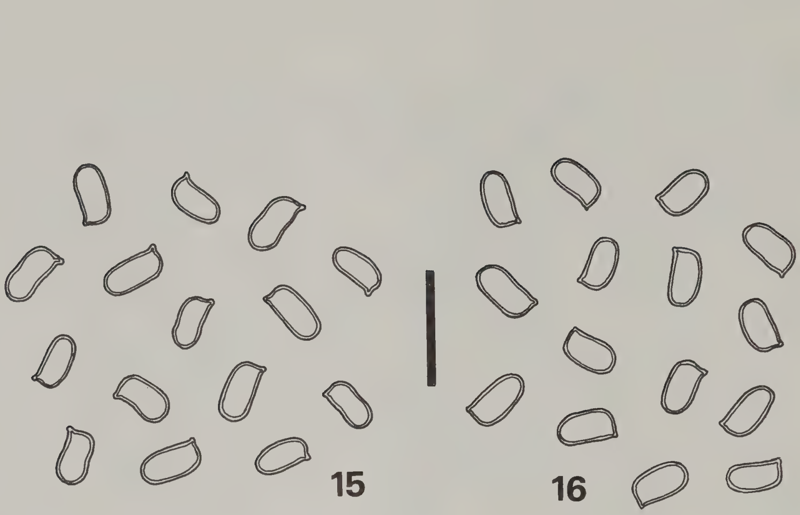
Basionym: *Odontia oblongispora* G.H. Cunn., Trans. Roy. Soc. New Zeal. 86: 95, 1959.

Basidiocarp resupinate, hydnoid, gossypine, forming circular or elongated patches of up to 10 x 3 cm, very easily detachable from the substrate, 180-250 µm thick. Hymenial surface hydnoid, sometimes irpicoid, continuous between the teeth and there felty, plushy or porulose, pale yellowish (2.5Y 8/4) or yellow (2.5Y 8/6), with chestnut (10YR 6/6 7/6) areas; teeth scattered or abundant and crowded, conic, subulate, cylindric or flattened, 0.1-5 mm long, their bases 75-250 µm wide, thinning out towards the apex, forming solitary, double or up to 4 tips. Subiculum cottony, white, 150-200 µm thick. Margin white or concolorous with the hymenial surface but always with a lighter hue, mycelial or pellicular, detachable from the substrate. Rhizomophs absent.

Hyphal system monomitic. Generative hyphae clamped, 2-4 µm diam, with walls generally thick-walled, up to 1 µm, compactly arranged, parallel to the main axis of the tooth; with dense, yellowish to chestnut cytoplasmatic contents in the chestnut areas of the hymenial surface.



Figs. 11-14. *Hypochniciellum oblongisporum* (AG 1214): vertical section through the basidiocarp. 11. Spores. 12. Septocystidia. 13. Basidia. 14. Subicular hyphae. Bar=10 µm.



Figs. 15-16. *Hypochniciellum oblongisporum*: 15. Spores of Holotype (PDD 17981). 16. Spores of Argentinian material (BAFC 50032). Bar=10 µm.

Septocystidia few, thick-walled, 50-120 x 5-6 µm, projecting up to 30 µm beyond the hymenium, little differentiated from hyphae.
Basidia claviform, 15-25 x 4-5 µm, with 4 sterigmata and a clamp at the base.
Basidiospores ellipsoid to oblong, some with a slight median constriction, 4.0-5.0(-5.5) x 2.5-3.0 µm, pale yellow in 5% KOH; walls smooth, 0,4 µm thick, weakly amyloid, apparently two-layered, the outer layer blue in Melzer's reagent while the inner one remaining hyaline and refractive; with hyaline or chestnut colored contents, 1 (-3) guttulate.

Habitat: on fallen wood of *Fitzroya cupressoides* (Mol.) Johnst. ("alerce") and *N. pumilio*.

Material studied: ARGENTINA, CHUBUT, Los Alerces National Park, southern arm of lake Menéndez, in *F. cuppresoides* rainforest stand, leg. MR 11630 , 8.May.98 (BAFC 50032, duplicate DAOM 225921). Ibid., leg. AG 1625 and AG 1628, 8.May.98. NEUQUÉN, Los Lagos, Laguna Rosales, lote 43, in pure *N. pumilio* stand, leg. AG 1214, 2.Nov.97. Ibid., leg MR 11718, 17.Oct.98 (BAFC 50033). NEW ZEALAND, Auckland, Piha Valley, on *Agathis australis* (D. Don) Lindley, leg. J.M. Dingley, Aug.53 (PDD 17980). Rangitoto Is., on *Metrosideros excelsa* Sol. ex Gaertn., leg. J.M. Dingley, Jul.50 (PDD 17984). Upper Piha Valley, Waitakeres, 900 ft, leg. J.M. Dingley, Aug.53 (Holotype, PDD 17981). Waitakere Ranges, Spragg track, on *Agathis australis*, leg. MR, 2.Aug.98. Otago, Alton Valley, Tuatapere, on *Podocarpus hallii*, leg. J.M. Dingley, Feb.54.

Remarks: Septocystidia are lacking in many sections and may appear lacking from the basidiocarp at first examination. Cunningham (1959) also recorded cystidia in specimens from New Zealand. The combination of a gossypine basidiocarp, a monomitic hyphal system with clamped generative hyphae, and small, smooth, amyloid spores supports the combination in *Hypochniciellum* Hjortstam & Ryvarden. *Hypochniciellum iaganicum* (Speg.) Rajchenberg & Wright (1987) also presents spores with two-layered walls with differential IKI reaction. The hydnoid hymenophore with rather long teeth is a unique feature in the genus. This is the 2nd corticioid species known to present an austral distribution (Greslebin & Rajchenberg, 1997).

Acknowledgments

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Literature

Cabrera, A. L. and A. Willink. 1980. Biogeografía de América Latina. Secretaría General de la O.E.A. Programa de Desarrollo Científico y Tecnológico. Serie Biología. Monografía Nº 13. 122 p.

Cunningham, G.H.C., 1959. Hydnaceae of New Zealand Part II. The genus *Odontia*. Trans. Roy. Soc. New Zealand 86: 65-103.

Eriksson, J., K. Hjortstam and L. Ryvarden, 1981. The Corticiaceae of North Europe. Vol 6. Fungiflora. Oslo.

Greslebin, A. and M. Rajchenberg, 1997. Corticioid Corticioid Aphyllophorales (Basidiomycota) from the Patagonian Andes Forests of Argentina 1. Lachnocladiaceae on *Nothofagus pumilio*. Mycotaxon 65: 197-203.

Greslebin, A. and M. Rajchenberg, 1998. Corticioid Corticioid Aphyllophorales (Basidiomycota) from the Patagonian Andes Forests of Argentina 3. The genus *Dendrothele*. Mycotaxon 67: 469-486.

Rajchenberg, M. & Wright, J.E., 1987. Type studies of Corticiaceae and Polyporaceae (Aphyllophorales) described by C. Spegazzini. Mycologia 79: 246-264.

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CONTRIBUTION TO THE MYCOLOGICAL KNOWLEDGE OF ANDALUSIA: THE GENUS AMANITA IN THE PROVINCE OF CORDOBA (SOUTHERN SPAIN)

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ABSTRACT: A tentative check-list of the genus *Amanita* (Basidiomycotina) from province of Córdoba (Spain), based on field colections and bibliographical records, is showed here. The list includes 23 taxa, from which, two are metioned for the first time in Andalusia, one for Western Andalusia and 9 for the province of Córdoba. A key to their determination, is included too.

Key words: *Amanita*, Agaricales, fungi, chorology, Andalusia.

RÉSUMÉ: Nous presentons le catalogue provisoire du genre *Amanita* (Basidiomycotina) de la province de Córdoba (Espagne), pour sa realisation nous sommes basés sur les recoltes propies et sur les references bibliografiques. Nous nous citons 23 taxa detaché parmis eux 2 nouvelles references pour l'Andalusie, une pour l'Andalusie Occidental et 9 pour la province de Córdoba. En incluyant en plus une clé pour l'identification du dit taxa.

MOTS-CLÉS: *Amanita*, Agaricales, champignon, chorologie, Andalucía.

INTRODUCTION

None of the various studies on Basidiomycetes in Andalusia (CALONGE & TELLERÍA, 1980; CALONGE *et al.*, 1994; ESTEVE-RAVENTÓS *et al.*, 1994; JIMÉNEZ-ANTONIO *et al.*, 1993, 1996; ORTEGA, 1992a; ORTEGA *et al.*, 1994; etc.), has been exclusively focussed on the genus *Amanita*, references to which in the province of Córdoba (southern Spain) are scant and all very recent. Such scarcity of information about this genus in our province (ANGUITA *et al.*, 1992; GÓMEZ *et al.*, 1993, 1995; JIMÉNEZ-ANTONIO *et al.*, 1993, MORENO-ARROYO *et al.*, 1996, CASTRO-CERCEDA *et al.*, 1997), led us to undertake the present study.

The province of Córdoba (Andalusia) is located in the southwest of Spain (figure 1). The climate of Córdoba is of the subcontinental, subhumid type. The annual average of the precipitations is 672 mm; the rainfall peaks during the autumn and winter months, and decreases gradually through the spring to virtually zero in the summer (figure 2). As a result, the optimal period for carpophore development is very short (typically from October to mid-December).

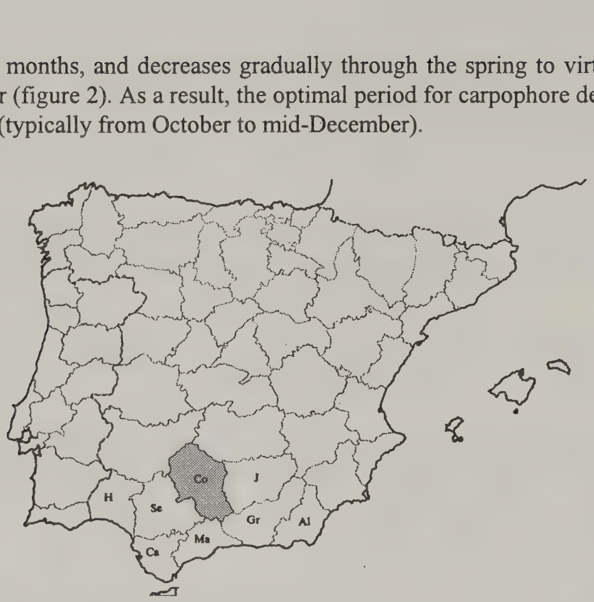

Figure 1.- Provinces considered in Spain. Andalusia: Co=Córdoba (in gray), Al=Almería, Ca=Cádiz, Gr=Granada, H=Huelva, J=Jaén, Ma=Málaga, Se=Sevilla.

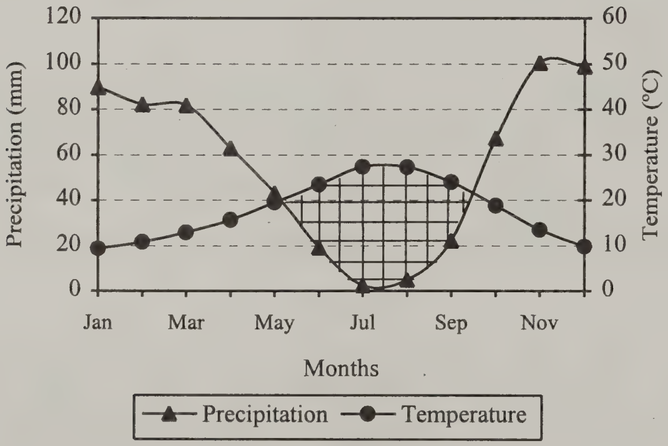

Figure 2.- Climatic diagram of province of Córdoba (data of a period of 40 years).

The vegetation is of the Mediterranean type and comprises remnants of a former sclerophyllous cover of *Quercus ilex* L. subsp. *ballota* (Desf.) Samp., in addition to undergrowth of *Q. coccifera* L., *Pistacia lentiscus* L. and *Arbutus unedo* L., among other species. The vegetation of the province also includes species resulting from strong anthropic alteration. Thus, there are large areas covered by scrub of *Cistus* *ladanifer* L. and *Genista hirsuta* Vahl on acid soil, and of thyme (*Thymus*) on calcareous soil.

Most of the mycological material examined was collected between 1992 and 1998. Once dry, it was deposited in the Herbarium of the Plant Biology (Botany) Department of the University of Córdoba [COFC(F)-]. Duplicate specimens of the more interesting species were submitted to Dr M.L. Castro (LOU-Fungi).

CATALOGUE

This paper includes those *Amanita* that were either collected by ourselves or mentioned in the references to Andalusia by other authors. Taxa are alphabetically arranged in the catalogue. For each species, the following information is given: genus and species epithet, author, protologue, most commonly used synonyms, ecology and chorology. The locality of material studied is represented by a number (at the end of the catalogue, we have included, in table 1, an index of the localities - Loc.- with its number and its geographical coordinates UTM), the collection date, the herbarium record number assigned, and references in Andalusia reported by other authors. An identification key, adapted to the 23 taxa included in the paper, is provided at the end.

***Amanita ceciliae* (Berk. & Broome) Bas, Persoonia 12(2):192. 1984**
=*A. inaurata* Secr. ex Gillet
=*A. strangulata* (Fr.) Quél.

ECOLOGY: Frequent. Fructifies between November and December and, occasionally in May, when the spring is rainy. Grows alone or in groups of 2-3 specimens; occasionally fairy rings, consisting of about 20 specimens, have been encountered. Located under holm oaks, cork oaks and their corresponding degradation stages, as well as in mixed forest.

MATERIAL STUDIED: Loc.- 5, 1-XII-1994, COFC(F)-1132; Loc.- 8, 18-XII-1994, COFC(F)-1265; Loc.- 9, 10-XI-1997, COFC(F)-1820; Loc.- 13, 1-XII-1994, COFC(F)-1147; Loc.- 15, 6-XII-1994, COFC(F)-1198; Loc.- 19, 6-XII-1994, COFC(F)-1186; Loc.- 22, 26-XI-1994, COFC(F)-1047; Loc.- 23, 22-XI-1994, COFC(F)-1090; Loc.- 25, 14-XI-1992, COFC(F)-739.

PREVIOUS REFERENCES IN ANDALUSIA: Córdoba (ANGUITA *et al.*, 1992; GÓMEZ *et al.*, 1995; MORENO-ARROYO *et al.*, 1996) y Huelva (ORTEGA *et al.*, 1994; ROMERO DE LA OSA, 1996).

***Amanita citrina* (Schaeff.) Pers., Tent. Disp. Meth. Fung.: 6. 1797**
=*A. mappa* (Batsch) Quél.

ECOLOGY: Frequent species that fructifies from late September to early January, on acid soils in chestnut groves and under tree groups consisting of *Quercus* and *Pinus* accompanied by *Cistus* thickets.

MATERIAL STUDIED: Loc.- 5, 6-XII-1994, COFC(F)-1182; Loc.- 10, 1-XII-1994, COFC(F)-1129; Loc.- 14, 27-XI-1994, COFC(F)-981; Loc.- 16, 10-XII-1997, COFC(F)-1902; Loc.- 17, 19-X-1997, COFC(F)-1790; Loc.- 20, 25-XI-1992, COFC(F)-731; Loc.- 23, 22-XI-1994, COFC(F)-1057; Loc.- 28, 6-XI-1992, COFC(F)-1243.

Previous references in Andalusia: Almería (Castro-Cerceda *et al.*, 1997), Cádiz (Castro-Cerceda *et al.*, 1997), Granada (Ortega & Buendía, 1986; Ortega *et al.*, 1996), Huelva (Romero de la Osa, 1991; Ortega *et al.*, 1994; Moreno-Arroyo *et al.*, 1996), Jaén (Anguita *et al.*, 1992; Jiménez-Antonio *et al.*, 1993; Calonge *et al.*, 1994; Jiménez-Antonio, 1994; Esteve-Raventós *et al.*, 1995) y Málaga (Ortega *et al.*, 1997).

***Amanita codinae* (Maire) Singer, Lilloa 22:388. 1951**

≡*Lepidella codiane* Maire

=*Amanita vittadinii* var. *codinae* (Maire) Vesely

=*A. vitadinii* f. *codinae* (Maire) J.-E. Gilbert

Ecology: Rare species that usually occurs in groups of 5-12 specimens. Fructifies from September to November on stony soils in *Quercus* meadows and in grazing land frequented by bovine cattle.

Material studied: Loc.- 1, 20-XI-1994, COFC(F)-1398; Loc.- 21, 17-XI-1993, COFC(F)-733.

Previous references in Andalusia: Huelva (Romero de la Osa, 1996) y Jaén (Reyes-García, 1995).

Amanita curtipes* J.-E. Gilbert, Amanitaceae 27, suppl. 1(2):279. 1941 var. *curtipes

=*Amanita valens* (J.-E. Gilbert) Bertault

Ecology: Occurs in isolation or in groups of 2-5 specimens. Rare to frequent, depending on the climatic features of the year. Fructifies between October and late December on the edge of forest tracks and in thinned areas populated by *Pinus*, *Quercus* and *Cistus ladanifer* L.

Material studied: Loc.- 8, 18-XII-1994, COFC(F)-1252; Loc.- 11, 13-XII-1994, COFC(F)-1283; Loc.- 17, 19-X-1997, COFC(F)-1799; Loc.- 19, 6-XII-1994, COFC(F)-1240; Loc.- 26, 18-XII-1994, COFC(F)-1330; Loc.- 31, 28-XII-1993, COFC(F)-743; Loc.- 36, 14-XII-1993, COFC(F)-734.

Previous references in Andalusia: Córdoba (Gómez *et al.*, 1995), Huelva (Calonge & Tellería, 1980; Ortega *et al.*, 1991; Ortega *et al.*, 1994; Mendaza, 1996) y Jaén (Anguita *et al.*, 1992; Jiménez-Antonio *et al.*, 1993; Calonge *et al.*, 1994; Jiménez-Antonio, 1994; Esteve-Raventós *et al.*, 1995; Moreno-Arroyo *et al.*, 1996).

Observations: For the nomenclature of this taxon we have based on Castro-Cerceda (1997).

***Amanita curtipes* var. *ponderosa* (Malençon & R. Heim) M.L. Castro, Doc. Mycol. 27(106):45. 1997**

Ecology: Very rare taxon that fructifies in late March in meadows of *Quercus suber* L. interspersed with *Cistus*.

Material studied: Loc.- 33, 21-III-1998, BM-3004; Loc.- 34, 30-III-1997, COFC(F)-1563.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (MORENO *et al.*, 1975; MORENO-ARROYO *et al.*, 1996) Córdoba (MORENO-ARROYO *et al.*, 1996), Huelva (MORENO *et al.*, 1975; CALONGE & TELLERÍA, 1980; MENDAZA & DÍAZ, 1981; ROMERO DE LA OSA, 1991; ORTEGA *et al.*, 1994; MORENO-ARROYO *et al.*, 1996; ORTEGA *et al.*, 1996; CASTRO-CERCEDA & FREIRE, 1997), Málaga (MORENO-ARROYO *et al.*, 1996) y Sevilla (MENDAZA & DÍAZ, 1981).

OBSERVATIONS: For the nomenclature of this taxon we have based on CASTRO-CERCEDA (1997).

***Amanita franchetii* (Boud.) Fayod, Ann. Sci. Nat. (Bot.), ser. 7:316. 1889**

=*A. aspera* (Vittad.) Quél.

ECOLOGY: Rare or infrequent species that fructifies from October to December on acid soil under tree groups of *Quercus* and *Pinus*.

MATERIAL STUDIED: Loc.- 14, 8-XII-1993, COFC(F)-744; Loc.- 17, 19-X-1997, COFC(F)-1910; Loc.- 23, 4-XII-1994, COFC(F)-1139; Loc.- 35, 25-XI-1996, COFC(F)-1575.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (ORTEGA *et al.*, 1997) y Huelva (ROMERO DE LA OSA, 1991).

OBSERVATIONS: The cuticle in our specimens varied from yellowish brown to greyish brown in colour.

***Amanita fulva* (Schaeff.) Fr., Observ. Mycol.: 2. 1815**

≡*Amanitopsis fulva* (Schaeff.) Fayod

=*Amanita vaginata* var. *fulva* (Schaeff.) Sacc.

ECOLOGY: Very rare. Fructifies in October, in isolation or in groups of 8-10 specimens, on acid soils under *Quercus suber* L.

MATERIAL STUDIED: Loc.- 10, 12-XI-1997, COFC(F)-1834.

PREVIOUS REFERENCES IN ANDALUSIA: Huelva (ORTEGA *et al.* 1994) y Málaga (CASTRO-CERCEDA *et al.*, 1997).

***Amanita gracilior* Bas & Honrubia, Persoonia 11:511. 1982**

ECOLOGY: Very rare species that fructifies in October on calcareous soils under tree groups of *Quercus faginea* Lam. and *Q. ilex* L. subsp. *ballota* (Desf.) Samp.

MATERIAL STUDIED: Loc.- 35, 22-XI-1997, COFC(F)-1950.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (CASTRO-CERCEDA *et al.*, 1997; ORTEGA *et al.*, 1997), Córdoba (GÓMEZ *et al.*, 1995; MORENO-ARROYO *et al.*, 1996), Huelva (ROMERO DE LA OSA, 1991; MENDAZA & DÍAZ, 1995) y Jaén (JIMÉNEZ-ANTONIO, 1994).

***Amanita lactea* Malençon, Romagn. & Reid, Rev. Mycol., nouv. sér. 32(5):408. 1968**

ECOLOGY: Fructifies from October to December and also, very rarely, in May. Occurs in the warm zone of the studied area, under *Quercus ilex* L. subsp. *ballota* (Desf.) Samp. and *Q. coccifera* L., with *Cistus albidus* L., typical of neutral and calcareous soils.

MATERIAL STUDIED: Loc.- 5, 30-XI-1992, COFC(F)-1373; 01-XII-1994, COFC(F)-1375; 06-XII-1994 COFC(F)-1374; 03-XII-1997 COFC(F)-1837; 11-V-1998 COFC(F)-2033.

OBSERVATIONS: This taxon is rare in Spain. In Andalusia, it has only been reported to occur in the provinces of Córdoba and Huelva (CASTRO-ORTIZ *et al.*, 1998). It is a rare taxon that occurs in Morocco, France, Greece (TULLOSS, 1994) and Italy (MERLO & TRAVERSO, 1983).

***Amanita lividopallescens* (Secr. ex Gillet) Seyot var. *malleata* Piane ex Romagn., Bull. Soc. Mycol. France 98(2):169. 1982**

=*A malleata* Piane

ECOLOGY: Very rare taxon that fructifies from October to November on acid soil, on path fringes and near *Cistus* species.

MATERIAL STUDIED: Loc.- 7, 16-XI-1994, COFC(F)-1161; Loc.- 17, 19-X-1997, COFC(F)-1925.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (ORTEGA, 1992a; ORTEGA *et al.* 1997), Granada (ORTEGA, 1992b), Huelva (ORTEGA *et al.* 1994) y Málaga (ORTEGA, 1992b).

OBSERVATIONS: The appearance of one of the specimens was consistent with the description of GARCIN (1984) for *Amanita lividopallescens* var. *tigrina* Romagn. ex Bon; however, we decided to include it in the var. *malleata* until further confirmation was obtained.

***Amanita mairei* Foley, Soc.Hist. Nat. Afrique N., mém. hors-sér. 2:117, pl. 4, fig 1. 1949**

ECOLOGY: Frequent. Fructifies from October to early December in weathered zones, boundaryes, meadows and among different *Cistus* species.

MATERIAL STUDIED: Loc.- 7, 16-X-1997, COFC(F)-1789; Loc.- 17, 19-X-1997, COFC(F)-1947; Loc.- 19, 6-XII-1994, COFC(F)-1234; Loc.- 24, 13-XI-1994, COFC(F)-963; Loc.- 25, 24-X-1997, COFC(F)-1805.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (CASTRO-CERCEDA *et al.*, 1997; ORTEGA *et al.*, 1997), Granada (ORTEGA & BUENDÍA, 1986; ORTEGA *et al.*, 1997) y Jaén (JIMÉNEZ-ANTONIO *et al.*, 1993; ESTEVE-RAVENTÓS *et al.*, 1995).

Amanita muscaria* (L.: Fr.) Hook, Fl. Scot. 2:19. 1821 var. *muscaria

ECOLOGY: Infrequent species that occurs only in the coldest, most humid zones of the studied area, and only in the northern half of the province. Fructifies from November to December, either alone or in groups, under *Cistus ladanifer* L. in weathered zones with scattered trees of *Quercus* and *Pinus*.

MATERIAL STUDIED: Loc.- 3, 17-XII-1996, COFC(F)-1571; Loc.- 15, 18-XII-1994, COFC(F)-1336; Loc.- 26, 1-XII-1992, COFC(F)-742.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (LEIVA, 1994; ORTEGA *et al.*, 1997), Córdoba (CASTRO-CERCEDA *et al.*, 1997), Granada (ORTEGA *et al.*, 1996), Huelva (CALONGE & TELLERÍA, 1980; ROMERO DE LA OSA, 1991; ORTEGA *et al.*, 1991; ORTEGA *et al.*, 1994), Jaén (ANGUITA *et al.*, 1992; JIMÉNEZ-ANTONIO *et al.*, 1993; JIMÉNEZ-ANTONIO, 1994) y Málaga (CASTRO-CERCEDA *et al.*, 1997).

Amanita muscaria **(L.: Fr.) Hook var. *formosa* (Pers.) Bertillon, [in Dechambre]. Dict. Encycl. Sci. Médic. I(3):496. 1866**

ECOLOGY: Very rare taxon. The sole specimen reported was found in December on slatey soil under *Cistus ladanifer* L. in a zone of scattered pine trees.

MATERIAL STUDIED: Loc.- 2, 20-XII-1992, COFC(F)-749.

Amanita ovoidea **(Bull.: Fr.) Link, Handb. Erkenn. Gewächse: 273. 1833**

ECOLOGY: Frequent species that occurs essentially between October and November; occasionally, it has also been collected in August, following several rainy days. Fructifies in isolation or in groups of 2-3 specimens on scarcely developed calcareous soils covered by holm oaks and mixed forest; however, it has also been found under *Cistus ladanifer* L.

MATERIAL STUDIED: Loc.- 14, 18-XII-1994, COFC(F)-920; Loc.- 27, 12-VII-1992, COFC(F)-748; Loc.- 35, 22-XI-1997, COFC(F)-1842.

PREVIOUS REFERENCES IN ANDALUSIA: Almería (HONRUBIA & LLIMONA, 1983), Córdoba (ANGUITA *et al.*, 1992; GÓMEZ *et al.*, 1993; BARNÉS-PÉREZ, 1995; GÓMEZ *et al.*, 1995), Granada (ORTEGA & BUENDÍA, 1986; ORTEGA *et al.*, 1996), Huelva (ROMERO DE LA OSA, 1996), Jaén (ANGUITA *et al.*, 1992; JIMÉNEZ-ANTONIO *et al.*, 1993; CALONGE *et al.*, 1994; JIMÉNEZ-ANTONIO, 1994; ESTEVE-RAVENTÓS *et al.*, 1995; MORENO-ARROYO *et al.*, 1996) y Málaga (CASTRO-CERCEDA *et al.*, 1997).

Amanita pantherina **(DC.: Fr.) Krombh., Abbild. Schwämm. 4: pl. 29, fig 10. 1836 var. *pantherina***

ECOLOGY: It is located exclusively in the north of the province, where it is very frequent. Fructifies from October to November, both in isolation and in groups, occasionally forming fairy rings. Grows on acid soil under holm oaks, cork oaks and chestnut trees.

MATERIAL STUDIED: Loc.- 3, 19-XI-1996, COFC(F)-1576; Loc.- 6, 8-XI-1992, COFC(F)-732; Loc.- 7, 16-XI-1994, COFC(F)-966; Loc.- 13, 23-XI-1997, COFC(F)-1949; Loc.- 23, 13-XI-1994, COFC(F)-962; Loc.- 29, 20-X-1996, COFC(F)-1558.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (CASTRO-CERCEDA *et al.*, 1997; ORTEGA *et al.*, 1997), Córdoba (GÓMEZ *et al.*, 1995; MORENO-ARROYO *et al.*, 1996), Granada (ORTEGA *et al.*, 1996), Huelva (CALONGE & TELLERÍA, 1980; ROMERO DE LA OSA, 1991; ORTEGA *et al.*, 1994), Jaén (JIMÉNEZ-ANTONIO *et al.*, 1993; CALONGE *et al.*, 1994; JIMÉNEZ-ANTONIO, 1994; ESTEVE-RAVENTÓS *et al.*, 1995) y Málaga (CASTRO-CERCEDA *et al.*, 1997).

Amanita phalloides **(Vaill.: Fr.) Link, Handb. Erkenn. Gewäsche: 272. 1833**

ECOLOGY: Like the previous taxon, this occurs in the northern half of the province, where it is quite abundant. Fructifies from October to December, both in isolation and in groups of 2-6 specimens, under holm oaks and mixed forest, and near riparian vegetation.

MATERIAL STUDIED: Loc.- 3, 17-XI-1996, COFC(F)-1564; Loc.- 4, 20-X-1996, COFC(F)-1560; Loc.- 5, 6-XII-1994, COFC(F)-1241; Loc.- 7, 28-XI-1997, COFC(F)-1851; Loc.- 11, 13-XII-1994, COFC(F)-1295; Loc.- 14, 26-XI-1994, COFC(F)-1000; Loc.- 28, 19-XI-1996, COFC(F)-1569; Loc.- 32, 14-XI-1992, COFC(F)-741.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (LEIVA, 1994; ORTEGA *et al.*, 1997), Córdoba (MORENO-ARROYO *et al.*, 1996), Granada (ORTEGA & BUENDÍA, 1986; ORTEGA *et al.*, 1996), Huelva (ROMERO DE LA OSA, 1991; ORTEGA *et al.*, 1994), Jaén (ANGUITA *et al.*, 1992; JIMÉNEZ-ANTONIO *et al.*, 1993; JIMÉNEZ-ANTONIO, 1994; ESTEVE-RAVENTÓS *et al.*, 1995) y Sevilla (CASTRO-CERCEDA *et al.*, 1997).

OBSERVATIONS: This taxon includes the references to *Amanita phalloides* var. *alba* (Vittad.) J.-E. Gilbert.

Amanita rubescens **(Pers.: Fr.) Gray, Nat. Arr. Br. Pl.:600. 1821**

ECOLOGY: Very rare, occurs between November and December though in very rainy springs, specimens have been encountered in May. Grows both in isolation and in groups of 3-4 specimens, essentially under holm oaks and their degradation stages, but also in mixed forest.

MATERIAL STUDIED: Loc.- 7, 13-XI-1994, COFC(F)-1023; Loc.- 14, 27-XI-1994, COFC(F)-1019; Loc.- 17, 23-V-1997, COFC(F)-1581; Loc.- 32, 6-XII-1993, COFC(F)-735.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (CASTRO-CERCEDA *et al.*, 1997; ORTEGA *et al.*, 1997), Jaén (ANGUITA *et al.*, 1992; ESTEVE-RAVENTÓS *et al.*, 1995) y Huelva (CALONGE & TELLERÍA, 1980; ROMERO DE LA OSA, 1991; ORTEGA *et al.*, 1994; MORENO-ARROYO *et al.*, 1996).

OBSERVATIONS: Highly variable in size and colour.

Amanita solitaria **(Bull.: Fr.) Mérat, Nouv Fl. Environs Paris [4ª ed.] 1:121. 1836**

=*A. echinocephala* (Vittad.) Quél.

ECOLOGY: Very rare species that fructifies in March on acid soils under *Quercus ilex* L. subsp. *ballota* (Desf.) Samp.

MATERIAL STUDIED: Loc.- 18, 11-III-1998, COFC(F)- 1955.

PREVIOUS REFERENCES IN ANDALUSIA: Granada (ORTEGA & BUENDÍA, 1986), Huelva (ROMERO DE LA OSA, 1991; ORTEGA *et al.*, 1994) y Jaén (JIMÉNEZ-ANTONIO *et al.*, 1993).

Amanita spissa **var. *valida*** **(Fr.) Dörfel & I.L. Roth, SchrReihe Vogtlandmus. Plauen 49:24. 1982**

=*A. valida* (Fr.) Bertillon

ECOLOGY: A rare taxon in the studied area. Fructifies in December on acid soils under *Quercus suber* L.

MATERIAL STUDIED: Loc.- 10, 2-XII-1997, COFC(F)-1927.

PREVIOUS REFERENCES IN ANDALUSIA: Huelva (CALONGE & TELLERÍA, 1980; ORTEGA *et al.*, 1997).

Amanita supravolvata **Lanne, Doc. Mycol. 9(34):24. 1979**

ECOLOGY: Very rare species that fructifies alone in October, in thinned zones of *Quercus ilex* L. subsp. *ballota* (Desf.) Samp.

MATERIAL STUDIED: Loc.- 22, 28-XI-1992, COFC(F)-1494.

OBSERVATIONS: Based on the literature reviewed, our reference represents the southernmost occurrence of this taxon in Europe. It had formerly been encountered by CASTRO-CERCEDA (1996) in Galicia (N.W. Spain).

Amanita umbrinolutea **(Secr. ex Gillet) Bataille, Bull. Soc. Mycol. France 26:139. 1910**

=*Amanita vaginata* var. *umbrinolutea* (Secr. ex Gillet) J.-E. Gilbert

ECOLOGY: Rare species that is usually found in groups of 2-5 specimens during October and November, both in meadows under *Quercus ilex* L. subsp. *ballota* (Desf.) Samp and in serial scrubs of *Cistus albidus* L. and *C. salvifolius* L.

MATERIAL STUDIED: Loc.- 12, 23-XI-1997, COFC(F)-1937; Loc.- 17, 19-X-1997, COFC(F)-1944; Loc.- 22, 25-X-1997, COFC(F)-1926.

PREVIOUS REFERENCES IN ANDALUSIA: Jaén (CASTRO-CERCEDA *et al.*, 1997).

Amanita vaginata **(Bull.: Fr.) Vittad., Descr. Fung. Mang.: 30. 1835 var. *vaginata***

≡*Amanitopsis vaginata* (Bull: Fr.) Roze

ECOLOGY: The most frequent and abundant species in the studied area. Grows from late September to mid-January; occasionally, it is also collected during the spring (May to June). Grows in all types of forest and their corresponding degradation stages, but more frequently under *Cistus*.

MATERIAL STUDIED: Loc.- 2, 27-XI-1994, COFC(F)-982; Loc.- 3, 27-XI-1994, COFC(F)-1017; Loc.- 5, 6-XII-1994, COFC(F)-1185; Loc.- 11, 13-XII-1994, COFC(F)-1275; Loc.- 12, 1-XII-1994, COFC(F)-1137; Loc.- 14, 22-V-1993, COFC(F)-747; Loc.- 15, 1-XII-1994, COFC(F)-1156; Loc.- 22, 26-XI-1994, COFC(F)-1002; Loc.- 23, 22-XI-1994, COFC(F)-1162; Loc.- 26, 18-XII-1994, COFC(F)-1338; Loc.- 30, 21-XI-1992, COFC(F)-738; Loc.- 32, 14-XI-1992, COFC(F)-740.

PREVIOUS REFERENCES IN ANDALUSIA: Almería (CASTRO-CERCEDA *et al.*, 1997), Cádiz (CASTRO-CERCEDA *et al.*, 1997; ORTEGA *et al.*, 1997), Córdoba (GÓMEZ *et al.*, 1993; BARNÉS-PÉREZ, 1995; GÓMEZ *et al.*, 1995; MORENO-ARROYO *et al.*, 1996), Granada (ORTEGA *et al.*, 1996), Huelva (ROMERO DE LA OSA, 1991; ORTEGA *et al.*, 1994), Jaén (JIMÉNEZ-ANTONIO *et al.*, 1991; JIMÉNEZ-ANTONIO *et al.*, 1993; CALONGE *et al.*, 1994; JIMÉNEZ-ANTONIO, 1994; ESTEVE-RAVENTÓS *et al.*, 1995) y Málaga (CASTRO-CERCEDA *et al.*, 1997).

Amanita vittadinii **(Moretti) Vittad., Tent. Mycol.: 31, pl. 1. 1826**

ECOLOGY: Rare species that fructifies in October, in groups of 5-8 specimens in thinned groves of *Quercus ilex* L. subsp. *ballota* (Desf.) Samp.

MATERIAL STUDIED: Loc.- 35, 22-XI-1997, COFC(F)-1845.

PREVIOUS REFERENCES IN ANDALUSIA: Cádiz (CALONGE *et al.*, 1994), Córdoba (GÓMEZ *et al.*, 1995), Huelva (ROMERO DE LA OSA, 1991) y Jaén (ESTEVE-RAVENTÓS *et al.* 1995; MORENO-ARROYO *et al.*, 1996).

Number	**Localities**	UTM
1	Belmez: Cortijo Viejo	30SUH0332
2	Cardeña: Sierra de Españares	30SUH8826
3	Cardeña: Venta del Charco	30SUH8829
4	Córdoba: Arroyo Bejarano	30SUH3401
5	Córdoba: Arroyo de Pedroche	30SUG4499
6	Córdoba: Baños de Popea	30SUH3300
7	Córdoba: Carretera Comarcal nº 110, Km 6-7	30SUG4099
8	Córdoba: Carretera Los Villares-Cerro Muriano	30SUH4209
9	Córdoba: Carretera Nacional nº 432, Km 258	30SUH4505
10	Córdoba: Carretera Vecinal nº 79, Km 5-6	30SUG3798
11	Córdoba: Casilla del Guapo	30SUH3100
12	Córdoba: Cerro Muriano	30SUH3707
13	Córdoba: Cerro Muriano	30SUH4307
14	Córdoba: Cerro Muriano	30SUH4404
15	Córdoba: Cortijo de La Conejera	30SUH4002
16	Córdoba: Cortijo de San Cristobal	30SUH4001
17	Córdoba: Cortijo Valdejetas	30SUH2900
18	Córdoba: Cortijo Villalicia	30SUH4406
19	Córdoba: Cortijo Virgen del Rosario	30SUG3899
20	Córdoba: El cruce de Trassierra	30SUG3596
21	Córdoba: Finca Campiñuela Alta	30SUH4600
22	Córdoba: Finca Rosal de las Escuelas	30SUG3497
23	Córdoba: Lagar del Caño de Escarabita	30SUG3598
24	Córdoba: Lagar del Caño de Escarabita	30SUH4307
25	Córdoba: Parque Periurbano de Los Villares	30SUH4004
26	Córdoba: Parque Periurbano de Los Villares	30SUH4105
27	Córdoba: Santa María de Trassierra	30SUG3399
28	Córdoba: Santa María de Trassierra	30SUG3498
29	Córdoba: Santa María de Trassierra	30SUH3225
30	Córdoba: Santuario de Linares	30SUH4600
31	Córdoba: Urbanización Las Jaras	30SUH3804
32	Obejo: Estación de Obejo	30SUH4310
33	Obejo: Laderas de Obejo	30SUH4221
34	Peñarroya-Pueblo Nuevo: Los Mestos	30SUH0741
35	Priego de Córdoba: El Navazuelo	30SUG8150
36	Villaviciosa de Córdoba: Finca La Lomilla	30SUH3306

Table 1. Index of localities of the material studied.

KEY TO SPECIES

Q (spore sphericity ratio) = length/width (BAS, 1969)

1 - Pileus margin striate since the beginning. Spores non-amyloid **2**
1'- Pileus margin not striate (striate only in older specimens). Spores amyloid . **12**
2 - Annulus absent, even in young specimens **3**
2'- Annulus present **9**
3 - Universal veil friable; volva with many sphaerocysts **4**
3'- Universal veil firm; volva with few or without sphaerocysts **5**
4 - Universal veil grey, leaving remnants on pileus and along stipe, never forming a typical saccate volva .... ***A. ceciliae***
4'- Universal veil white, leaving few remnants on pileus and forming a sacciform volva .... ***A. lividopallescens*** var. ***malleata***
5 - Volva very thick (> 3 mm) .... ***A. supravolvata***
5'- Volva thinner (< 3 mm) **6**
6 - Pileus grey coloured **7**
6'- Pileous differently coloured **8**
7 - Pileus silver grey coloured. Spores subelliptical-elliptical, 11-12 × 6.5-7.5 µm (Q = 1.6-1.7) .... ***A. mairei***
7'- Pileus lead grey coloured. Spores globose-spherical, 9.5-12.5 µm diam. (Q = 1) .... ***A. vaginata*** var. ***vaginata***
8 - Pileus greyish brown to ochraceous brown. Spores spherical, 10-14 µm diam. (Q = 1) .... ***A. umbrinolutea***
8'- Pileus reddish yellow to orange. Spores spherical, 8-14 µm diam. (Q = 1) .... ***A. fulva***
9 - Volva membranous. Annulus fragile .... ***A. lactea***
9'- Volva friable. Annulus firm **10**
10 - Volva consisting of remnants of universal veil forming one or several rows beyond the upper edge of basal bulb, which is usually marginate. Cuticle never red or orange .... ***A. pantherina*** var. ***pantherina***
10'- Volva consisting of crenate warts. Cuticle red or orange **11**
11 - Universal veil remnants white .... ***A. muscaria*** var. ***muscaria***
11'- Universal veil remnants creamy yellow .... ***A. muscaria*** var. ***formosa***
12 - Volva highly friable **13**
12'- Volva membranous **19**
13 - Volva usually dissociated over pileus, forming pyramidal warts. Pileus margin appendiculate **14**
13'- Volva dissociated over pileus as small warts or plates. Pileus margin non-appendiculate **17**
14 - Annulus creamy-farinose. Basidioma pure white in colour. Spores 10-13 × 6-10 µm (Q = 1.3-1.6) .... ***A. solitaria***
14'- Annulus without the previous features **15**
15 - Spores cylindrical .... ***A. gracilior***
15'- Spores elliptical **16**

16 - Stipe shorter than pileus diameter. Pileus coated with flat and pyramidal warts, brown coloured from the beginning. Lamellae creamy to yellowish. Spores 10-13.5 × 5.5-9 µm (Q = 1.5-1.8) .... ***A. codinae***

16'- Stipe larger than pileus diameter. Pileus with pyramidal, initially white patches that turn brown with age. Lamellae white to creamy. Spores 10-12.5 × 8-10 µm (Q = 1.2) .... ***A. vittadinii***

17 - Flesh and lamellae reddening with age .... ***A. rubescens***

17'- Flesh and lamellae not reddening with age **18**

18 - Universal veil remnants yellow-coloured .... ***A. franchetii***

18'- Universal veil remnants pale grey .... ***A. spissa*** var. ***valida***

19 - Annulus membranous, not disappearing readily **20**

19'- Annulus fugacious, only present in young specimens **21**

20 - Volva broad, clearly protruding from basal bulb. Pileus usually non-uniformly coloured, with predominant yellow-green shade. .... ***A. phalloides***

20'- Volva slightly protruding from marginate bulb. Pileus uniformly greenish-yellow coloured .... ***A. citrina***

21 - Basidioma large (total height >15 cm; pileus diameter >11 cm). Annulus creamy-farinose, well developed in young specimens, later as warts on pileus margin and along stipe. Flesh white coloured, invariable. .... ***A. ovoidea***

21'- Basidioma medium or small sized (total height <10 cm; pileus diameter <11 cm). Annulus farinose, highly fugacious, only detected in very young specimens, later leaving pulverulent remnants on stipe. Flesh reddening slightly with time **22**

22 - Stipe and pileus <6 cm. Pileus usually having large patches (universal veil remnants). Spores 11-14.5 × 5.5-8 µm (Q = 1.8-2) ... ***A. curtipes*** var. ***curtipes***

22'- Stipe and pileus >6 cm. Spores 10-13 × 5-6.5 µm (Q = 2) .... ***A. curtipes*** var. ***ponderosa***

CONCLUSIONS

This work includes 23 taxa of *Amanita* known up to now in the province of Córdoba. These taxa, suppose the 51% of the taxa known in the Iberian Peninsula and in the Balearic Islands; this fact denotes a great richness in *Amanita* in our province. Based on the literature reviewed, two such taxa, *A. muscaria* var. *formosa* and *A. supravolvata*, are reported in Andalusia for the first time; *A. umbrinolutea* was detected for the first time in western Andalusia; 9 others (*A. citrina*, *A. codinae*, *A. franchetii*, *A. fulva*, *A. mairei*, *A. lividopallescens* var. *malleata*, *A. rubescens*, *A. solitaria* and *A. spissa* var. *valida*) are reported for the first time in the province of Córdoba; and our reference of *A. supravolvata* represents the southernmost occurrence of this taxon in Europe.

Furthermore, our work provides new Andalusian localities to the last checklist on *Amanita*, presented of the Iberian Peninsula and the Balearic Islands (CASTRO-CERCEDA, 1998).

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REFERENCES

ANGUITA, C., C. FERNÁNDEZ, F. JIMÉNEZ-ANTONIO, D. LÓPEZ, D. MARTÍNEZ, I. MOLINA & T. PARRAS (1992). Setas de otoño Jaén Año 1991. *Lactarius* 1:23-33.

BARNÉS-PÉREZ, F. (1995). Exposición de setas en Priego de Córdoba. *Lactarius* 4:47-50.

BAS, C. (1969). Morphology and subdivision of *Amanita* and a monograph on its Section *Lepidella*. *Persoonia* 5:285-579.

CALONGE, F.D. & M.T. TELLERÍA (1980). Introducción al conocimiento de los hongos de Doñana (Huelva, España). *Lazaroa* 2:271-326.

CALONGE, F.D., F. JIMÉNEZ-ANTONIO, A. GUERRA, C. FERNÁNDEZ, P. BRIONES & M.J. GUIJOSA (1994). Setas de otoño en Jaén. Año 1993. *Lactarius* 3:26-37.

CASTRO-CERCEDA, M.L. (1996). Catálogo del género *Amanita* Pers. ex Hook. (*Agaricales*) en Galicia (España). *Anales Jard. Bot. Madrid* 54:61-67.

CASTRO-CERCEDA, M.L. (1997). Analyse critique des taxons appartenant au groupe *Amanita curtipes* Gilbert (Agaricales, Basidiomycotina). Distribution dans la Péninsule Ibérique. *Doc. Mycol.* 27(106):43-51.

CASTRO-CERCEDA, M.L. (1998). Annotated checklist of the Amanitaceae (Agaricales, Basidiomycotina) of the Iberian Peninsula and Balearic Islands. *Mycotaxon* 67:227-245.

CASTRO-CERCEDA, M.L., J. CHECA & F. PANDO (1997). Bases corológicas de Flora Micológica Ibérica, números 1224-1270. *Cuadernos de Trabajo de Flora Micológica,* 12. Madrid.

CASTRO-ORTIZ, A., F. INFANTE, J. GÓMEZ-ARJONA & M.L. CASTRO-CERCEDA (1998). *Amanita lactea* Malençon, Romagn. & Reid, an infrequent species in the Iberian Península. *Cryp. Mycol.* 19(3):203-205.

ESTEVE-RAVENTÓS, F., F. JIMÉNEZ-ANTONIO, A. GUERRA, M.B. ALTÉS, J. BALLESTEROS, E. CAMPOS, A. CASAS & C. FERNÁNDEZ (1995) Setas de otoño en Jaén. Año 1994. *Lactarius* 4:75-88.

GARCIN, R. (1984). *Les Amanites Europeennes*. Federat. Mycol. Dauphine-Savoie.

GÓMEZ, J., B. MORENO-ARROYO & A. ORTEGA (1993). *Setas del Parque Natural de las Sierras Subbéticas Cordobesas*. Ed. Rueda. Madrid.

GÓMEZ, J., B. MORENO-ARROYO & A. ORTEGA (1995). Contribución al estudio micológico de la provincia de Córdoba. I. Catálogo del Parque Natural de las Sierras Subbéticas y su entorno (Córdoba, España). *Bol. Soc. Micol. Madrid* 20:225-267.

HONRUBIA, M. & X. LLIMONA (1983). Aportación al conocimiento de los hongos del SE de España. X. *Boletales*, *Agaricales*, *Rusulales*. *Anales Biol., Fac. Biol., Univ. Murcia Ci.* 42(1-4):137-200.

JIMÉNEZ-ANTONIO, F. (1994). Contribución al estudio de los hongos de la provincia de Jaén. I. *Bol. Soc. Micol. Madrid* 19:111-154.

JIMÉNEZ-ANTONIO, F., A. BARROSO, J. CARBALLO, C. FERNÁNDEZ, M.J. MENDOZA & M.G. PARRA (1991). Setas de Otoño en Jaén. Años 1989-1990. *Bol. Inst. Giennenses* 144:287-301.

JIMÉNEZ-ANTONIO, F., A. GUERRA, C. FERNÁNDEZ, M.I. GALLARDO, G. JAÉN, F. MENDOZA, G.P. PEREIRA & M.C. VACAS (1993). Setas de otoño en Jaén. Año 1992. *Lactarius* 2:19-31.

JIMÉNEZ-ANTONIO, F., C. FERNÁNDEZ, J.A., MANCERA, R. MANCERA, B. MOLINES, M. MUÑOZ, J. RODRÍGUEZ, L. TARANCÓN & A. VICIANA (1996). Setas de otoño en Jaén. Año 1995. *Lactarius* 5:102-106.

LEIVA, J.A. (1994). Aspectos de la flora micológica en la provincia de Cádiz. *Lactarius* 3:53-55.

MENDAZA, R. (1996). *Las setas en la naturaleza. Tomo II.* Iberdrola. Bilbao.

MENDAZA, R. & G. DÍAZ (1981). *Las setas. Manual práctico para el aficionado.* Sección Micológica de Iberduero. Bilbao.

MENDAZA, R. & G. DÍAZ (1995). *Las setas en la naturaleza. Tomo I.* Iberdrola.

MERLO, E.G. & M. TRAVERSO (1983). *I nostri funghi. Le amanite.* Sagep Editrice, Genova. 151 pp.

MORENO-ARROYO, B., J. GÓMEZ, F. JIMENEZ-ANTONIO & F. INFANTE (1996). *Setas de Andalucía.* Centro Andaluz del Libro. Sevilla.

MORENO, G., F.D. CALONGE & M. DE LA TORRE (1975). Estudio ecológico y descriptivo de hongos interesantes españoles. *Bol. Est. Central Ecol.* 4(7):35-49.

ORTEGA, A. (1992a). Aportación al estudio de los hongos de Andalucía. X. *Agaricales. Rev. Iberoam. Micol.* 9:65-71.

ORTEGA, A. (1992b). *Setas de Andalucía oriental.* Ed. Colegio Oficial de Farmacéuticos de Granada.

ORTEGA, A. & A.G. BUENDÍA (1986). Contribución al catálogo micológico de Sierra Nevada (Granada, España). *Int. J. Mycol. Lichenol.* 3(1):17-54.

ORTEGA, A., F. ESTEVE-RAVENTÓS & G. MORENO (1994). Contribución al estudio micológico del Parque Natural de la Sierra de Aracena y Picos de Aroche (Huelva, España). *Bol. Soc. Micol. Madrid* 19:227-279.

ORTEGA, A., G. MORENO & F. ESTEVE-RAVENTÓS (1997). Contribución al estudio micológico del Parque Natural de los Alcornocales (Andalucía, España). *Bol. Soc. Micol. Madrid* 22:219-272.

ORTEGA, A., J. PIQUERAS & P. AMATE (1996). *Setas. Identificación, toxicidad y gastromicología.* Ediciones Proyecto Sur. Granada.

ORTEGA, A., M.T. VIZOSO & M. CONTU (1991). Notas sobre la micoflora xero-termofila y sabulícola de Andalucía (Primera parte). *Doc. Myc.* 21(82):19-42.

REYES-GARCÍA, J.D. (1995). Primeras jornadas micológicas en Santiago de la Espada (Jaén). *Lactarius* 4:89-92.

ROMERO DE LA OSA, L. (1991). Contribución al estudio de los hongos de la Sierra de Aracena (Huelva). *Bol. Soc. Micol. Madrid* 15:53-76.

ROMERO DE LA OSA, L. (1996). Contribución al estudio de los hongos de la Sierra de Aracena. IV. *Bol. Soc. Micol. Madrid* 21:7-30.

TULLOSS, R.E. (1994). Type studies in *Amanita* Section *Vaginatae* I: some taxa described in this century (studies 1-23) with notes on description of spores and refractive hyphae in *Amanita*. *Mycotaxon* 52(1):395-396.

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SOME IMPORTANT CORRECTIONS TO THE ASCOMYCETES RECORDED ON CYPERACEAE AND JUNCACEAE FROM THE EASTERN ALPS BY SCHEUER (1988)

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Abstract

The present paper is a compilation of important corrections to the work by Scheuer (1988, Bibliotheca Mycologica 123), dealing with small ascomycetes found on rotting leaves and stems of Cyperaceae and Juncaceae in the Eastern Alps. One nomen novum (*Pyrenopeziza perminuta*) and three new combinations (*Pyrenopeziza pubescens*, *Trichometasphaeria fusispora*, *Massarina pusillispora*) are proposed. The records of *Micropeziza cornea* and *Psilachnum eburneum* were based on misidentifications and must be deleted. All records listed under *Lophodermium* are problematic. A full annotated list of the taxa recorded by Scheuer (1988) will be available on the World Wide Web (http://www-ang.kfunigraz.ac.at/~scheuer/publ.htm).

Key Words: Mycobiota, mycoflora, mycota; fungi, saprophytes; Austria, Europe.

Scheuer (1988) recorded 153 taxa of ascomycetes (55 genera) fruiting on dead leaves and stems of Cyperaceae and Juncaceae in the Eastern Alps. Subsequently, a number of important taxonomic changes (new combinations, better delimitation of species, etc.) happened to the taxa treated in this work. Schmid-Heckel (1988), Nograsek (1990), Magnes & Hafellner (1991), and Nograsek & Matzer (1994) also treated a considerable number of taxa on Cyperaceae and Juncaceae from the area and contributed important corrections and additions. It should be noted here that some taxa described by Nograsek (1990) were validated in a later publication (Nograsek & Matzer 1991). In addition, some typographic errors, a few misidentifications, and similar mistakes have come to light. The present paper deals with all mistakes discovered so far, and covers some of the taxonomic changes and unsolved problems.

All other references cited below usually belong to taxonomic literature used for identification. Unless stated otherwise, herbarium specimens are deposited in GZU. The currently accepted names and the new combinations are printed in ***boldface italics***. A full annotated list of the taxa recorded by Scheuer (1988) will be available on the World Wide Web (http:/www-ang.kfunigraz.ac.at/~scheuer/publ.htm).

Rich collections of cypericolous and juncicolous ascomycetes from the area have been distributed in the exsiccata series 'Mycotheca Graecensis' (Scheuer & Poelt† 1997) and in the duplicate series 'Dupla Fungorum' (Scheuer 1997).

● ***Brunnipila calycioides*** (Rehm) Baral in Baral & Krieglsteiner 1985. — Magnes & Hafellner (1991) found that the apical ring of the asci shows an IKI+ red (hemiamyloid) reaction, not IKI+ blue (euamyloid) as erroneously indicated by Scheuer (1988). However, H.O. Baral (pers. comm.) noted that at low IKI concentrations both the IKI+ red (rr type) and the IKI+ blue (rb type) reaction may occur (see Baral 1987).

● ***Cistella hoehnelii*** Scheuer 1988 (as nomen novum)

Bas.: *Psilachnum granulosellum* Höhnel 1926
(**non** *Peziza granulosella* P. Karsten 1869 ≡ *Cistella granulosella* (P. Karst.) Nannf.)
≡ *Dasyscypha granulosella* (Höhn.) Dennis 1949
≡ *Clavidisculum granulosellum* (Höhn.) Raitviir 1970
Syn.: *Clavidisculum graminicola* Raitviir 1969
≡ *Cistella graminicola* (Raitv.) Raitviir 1978

When Scheuer (1988) based his nomen novum on Höhnel's (1926) protologue of *Psilachnum granulosellum* and on the description and drawings provided by Dennis (1949), he was not aware of the paper by Raitviir (1978) who had already provided a new combination in *Cistella* for a later synonym of *P. granulosellum*, viz. *Clavidisculum graminicola* Raitviir, and listed *P. granulosellum* as a synonym of *C. graminicola*. Magnes & Hafellner (1991) and Nograsek & Matzer (1994) followed Raitviir (1978) instead of Scheuer (1988) and also named their collections *C. graminicola*. However, a taxon with a valid description and a satisfactory type specimen cannot be neglected.

In the meantime, Höhnel's specimen of the type collection of *P. granulosellum* in FH was examined. It is designated here as the **LECTOTYPE**: 'Rehm: Ascomycetes exs. no. 1958. *Urceolella chionea* (Mass. et Crossl.) Rehm. An Blättern von *Carex pendula*. Pfalzau-Pressbaum im Wiener Wald, N.-Oesterreich. 4.1911, v. Keissler' (FH, Höhnel collection).

● ***Clathrospora heterospora*** (De Not.) Wehmeyer var. *heterospora*; Wehmeyer 1961, Shoemaker & Babcock 1992 as *C. heterospora*. — Scheuer (1988, Taf. 29, Fig. c) mentioned a collection on *Juncus jacquinii* L. (Austria, Salzburg, Hohe Tauern, Hafner-Gruppe, Oberer Rotgüldensee, 2000 m alt., 20.08.1981, leg. Ch. Scheuer) with extremely large ascospores ('70-90 × 32-44 × 15 μm'). However, when a representative number of ascomata in this collection was re-examined, those large ascospores were not found again. Presumably they had been studied during the process of swelling before germination.

● ***Coronellaria caricinella*** (P. Karst.) P. Karst.; Müller & al. 1964, Baral in Baral & Krieglsteiner 1985. — One of the alpine collections (on *Carex aterrima* Hoppe, Austria, Steiermark, Gurktaler Alpen, Turrach, Dieslingsee, 2000 m alt., 15.07.1930, leg. Genta) should be excluded from this species because the asci showed an IKI– apical apparatus when they were re-examined, just like the *'Coronellaria* cf. *caricinella'* treated by Nograsek & Matzer (1994). These IKI– collections probably belong to *Hysteronaevia* rather than *Coronellaria*. They are possibly conspecific with *Hysteronaevia fimbriata* Dennis & Spooner (1993).

● ***'Didymella' caricis*** H. Sydow 1921; Spooner & Dennis 1986. — See also below under *'Wettsteinina* cf. *niesslii'*. It must be noted here that two altitudes are given for one of the collections (on *Carex pendula* Huds., Austria, Oberösterreich, Schwarzberg S [of] Steyr, 21.04.1984, leg. Ch. Scheuer); 750 m is the correct altitude for this locality.

- *Gaeumannomyces* cf. tax. sp. 3 (Walker 1980). — The hyphopodia found in our collections apparently agree with those of Walker's (1980) '*Gaeumannomyces* tax. sp. 3', but the spores of this provisory taxon are much longer, (50)55-75(80) × 2-3(4) µm (Walker 1980). A collection on *Juncus gerardii* Loisel. from North Hoy (Orkney Is.; Dennis & Spooner 1992, 1993) agrees with our collections in ascospore characters (36-43 × 3.2-3.8 µm), but the hyphopodia figured by these authors look different. Unfortunately our material is too scant to provide a satisfactory holotype.

- ***Gibbera myrtilli*** (Cooke) Petr.; Barr 1968, Remler 1979. — This record was not properly listed but included in the discussion of the macroscopically similar *Niesslia exosporioides* (as *Gibbera* cf. *myrtilli*). The specimens agree with collections on the typical substrate, dead leaves of *Vaccinium myrtillus* L. (Ericaceae).

- *Hysteropeziza pubescens* Hein & Scheuer 1986. — *H. pubescens* and the following species, *H. pusilla*, belong in a group of species last treated by Défago (1968) under the generic name *Pyrenopeziza* (here termed the '*P. karstenii* group'). When Hein & Scheuer (1986) described *H. pubescens* and *H. pusilla*, they emended the generic name *Hysteropeziza* Rabenh. to accommodate these two species, but did not suggest new combinations for any other species of the *P. karstenii* group. However, the type species of *Hysteropeziza*, *H. erumpens* (Fr.) Rabenh. (a synonym of *Pyrenopeziza petiolaris* (Alb. & Schw.: Fr.) Nannf.) should not be removed from the genus *Pyrenopeziza* (Hütter 1958; H.O. Baral, pers. comm.). Nauta & Spooner (1999) also suggested that *Hysteropeziza* should be treated as a synonym of the earlier *Pyrenopeziza* Fuckel.

There is yet another, rather debatable possibility to separate the *P. karstenii* group from *Pyrenopeziza*. Saccardo (1884), when he described the genus *Belonium*, included only the species *Belonium graminis* (Desm.) Sacc. but drew up the generic description from material of what is now recognized as a different species, *Belonium hystrix* (De Not.) Höhn. As Baral (1994) pointed out, the type of *Belonium* is a specimen of *Peziza graminis* Desm. and that only by conservation could one change the application of the name *Belonium*. Baral (1994) suggested the adoption of *Cejpia hystrix* (De Not.) Baral, the abandonment of the ambiguously applied *Belonium*, and a review of the genera *Cejpia*, *Hysteropezizella* and *Coronellaria*. However, there is a case for the adoption of *Belonium* as originally typified (*Peziza graminis* Desm.). Desmazières' type material is now regarded as conspecific with either *Pyrenopeziza karstenii* Sacc. or *P. fuscescens* (Rehm) Défago. This is also supported by the illustrations provided by Boudier (1905-1910, pl. 548) under the name *Pyrenopeziza graminis* (Desm.) Sacc. *Belonium* Sacc. could therefore serve as a generic name for the *Pyrenopeziza karstenii* group. However, at present the generic taxonomy appears too unsettled to re-establish the generic name *Belonium* Sacc.

Hysteropeziza pubescens is clearly related to *Pyrenopeziza karstenii* and allied species as outlined by Défago (1968), and although the large genus *Pyrenopeziza* may be split up in the future, a new combination is suggested here:

Pyrenopeziza pubescens (Hein & Scheuer) Scheuer comb. nov.

Bas.: *Hysteropeziza pubescens* Hein & Scheuer 1986, Sydowia 38: 133.

- *Hysteropeziza pusilla* Hein & Scheuer 1986. — It must be added here that the ascomata of *Hysteropeziza pusilla* in the type collection were also found on **living** leaves which had persisted from the previous vegetation period. Any other collections published as *H. pusilla* so far are probably not conspecific with the type, e.g., the collections on *Carex paniculata* L. (Hein & Scheuer 1986) or *Carex rostrata* Stokes ex With. (Magnes & Hafellner 1991). Usually the ascus and ascospore sizes exceed the measurements given for the type collection on *Carex brizoides* L. (Magnes & Hafellner

1991). This is probably an aggregate of small to minute members of the *Pyrenopeziza karstenii* group, all keying out under *Hysteropeziza pusilla* at the moment.

For the same reasons as in *H. pubescens*, a new combination seems appropriate, but because of the earlier *Pyrenopeziza pusilla* Saccardo & Spegazzini (in Saccardo 1878, Michelia 1: 423) a nomen novum is necessary:

Pyrenopeziza perminuta Scheuer nom. nov.

Bas.: *Hysteropeziza pusilla* Hein & Scheuer 1986, Sydowia 38: 134.

● *Keissleriella fusispora* Scheuer 1988. — Barr (1987, 1990, 1992) found that the type species of the genus *Keissleriella* Höhn. belongs in the Melanommatales (Melanommataceae) and suggested to accommodate a number of former *Keissleriella* species in the genus *Trichometasphaeria* Munk (Pleosporales, Massarinaceae = Lophiostomataceae). Therefore the following new combination is proposed:

Trichometasphaeria fusispora (Scheuer) Scheuer comb. nov.

Bas.: *Keissleriella fusispora* Scheuer 1988, Biblioth. Mycol. 123: 86.

A typographic error occurred in the Latin diagnosis of the protologue. The corrected passage reads as follows:

`Sporae ... symmetricae, primum 1-septatae ...`

● ***Lachnum callimorphum*** (P. Karst.) P. Karst.; Dennis 1949 as *Dasyscypha callimorpha*, Raitviir 1970 as *Dasyscyphus callimorphus*, Dennis 1980 under *Dasyscyphus imbecillis*. — The two collections with longer-stalked ascomata on *Carex sempervirens* Vill. mentioned by Scheuer (1988) are conspecific with the collections on *Carex ericetorum* Pollich (confirm. H.O. Baral).

● ***Lachnum elongatisporum*** Baral in Raitviir & Sacconi 1991 (as nom. prov. in Baral & Krieglsteiner 1985); Dennis 1949 as *Dasyscypha carneola* var. *longispora*.

● ***Lachnum imbecille*** P. Karst.; Dennis 1980 as *Dasyscyphus imbecillis*, Schmid-Heckel 1988 as *Dasyscyphus imbecillis*. — It remains open to doubt whether the collections by Scheuer (1988) and Magnes & Hafellner (1991) are really conspecific with the type of *Lachnum imbecille* (H.O. Baral, pers. comm.; Dennis 1980).

● *Leptosphaeria caricis-firmae*: see under ***Phaeosphaeria c.***

● ***Lophodermium juncinum*** (Jaap) Terrier in Müller 1977 (sensu Terrier), on *Juncus trifidus* L., Austria, Salzburg, Radstädter Tauern, Esser Alm unterhalb vom Mosermandl [Mosermannl], 2100 m alt., 24.07.1982, leg. Ch. Scheuer. — This specimen was misidentified by Scheuer (1988) as *'Rhytisma' juncicola* (see below), and redetermined by P.R. Johnston (Auckland, 1996).

● *Lophodermium luzulae* Hazsl. — The ascomata in the collection from Switzerland listed by Scheuer (1988) were apparently immature and not identifiable (vid. P.R. Johnston, Auckland, 1996); see also annotations to *'Rhytisma' juncicola* below.

● *'Rhytisma' juncicola* Rehm; Rehm '1896'. — Except for the single specimen redetermined as *Lophodermium juncinum* sensu Terrier by P.R. Johnston (see above), all other identifications listed under *Lophodermium juncinum*, *L. luzulae* and *'Rhytisma' juncicola* by Scheuer (1988) are uncertain. However, it should be noted here that *Lophodermium luzulae* and *'Rhytisma' juncicola* agree in the structure of the ascoma wall. *Coccomyces coronatus* (Schum. ex Fr.) De Not., a species on leaves of deciduous trees, has the same wall structure (annot. P.R. Johnston, Auckland, 1996).

● *Massariosphaeria grandispora* (Sacc.) Leuchtmann 1984; Müller 1950 as *Leptosphaeria g.*, Holm & Holm 1988. — Although the laterally compressed ostiole is often lacking in smaller ascomata, the most convenient current name appears to be ***Lophiotrema grandisporum*** (Sacc.) Shoemaker & Babcock (1989).

● *Massariosphaeria pusillispora* Scheuer 1988. — The different concept for the genus *Massariosphaeria* (E. Müller) Crivelli suggested by Barr (1989, as *Chaetomastia* (Sacc.) Berl.) also excludes *M. pusillispora*. Scheuer (1991a) accommodated a very similar species in the genus *Massarina* Sacc. (Massarinaceae = Lophiostomataceae), *M. tetraploa* Scheuer. According to a revision of *Massarina* by Aptroot (1998), *M. tetraploa* was not combined into another genus. Therefore the following new combination is suggested:

Massarina pusillispora (Scheuer) Scheuer comb. nov.

Bas.: *Massariosphaeria pusillispora* Scheuer 1988, Biblioth. Mycol. 123: 100.

● *Micropeziza cornea* (Berk. & Broome) Nannfeldt 1976. — H.O. Baral (pers. comm.) has re-identified one of Scheuer's (1988) collections as ***'Hymenoscyphus' salmanovicensis*** Svrček (1978). All other collections recorded by Scheuer (1988) are conspecific. In addition, it must be noted here that this fungus has apparently nothing to do with *Trochila ignobilis* P. Karst., a synonym of the real *Micropeziza cornea* (Nannfeldt 1976).

● ***Monascostroma innumerosum*** (Desm.) Höhn.; Munk 1957, Müller & Arx 1962. — Apparently the somewhat longitudinal arrangement of the finely verruculose ascospore wall ornament figured by Scheuer (1988) is not a regular feature of the ascospore wall surface.

● ?*Montagnula* spec. indet. — Scheuer (1988) described and figured the coarsely ornamented, dark brown, almost opaque ascospore walls and suggested that this fungus might be a relative of *Montagnula opaca* (Wegelin) Crivelli with smaller, 'reduced' ascomata. It should be noted here that Nograsek (1990) did not follow this suggestion and placed two very similar species in the genus *Phaeosphaeria* Miyake, viz. *Ph. glebosoverrucosa* Nograsek and *Ph. nanosalicium* Nograsek. *Leptosphaeria kochiana* E. Müller (1951) is most probably another species of this group (E. Müller, pers. comm.).

● ***Mycosphaerella hypostomatica*** Höhn.; Tomilin 1979 (erroneously as *M. hypostromatica*). — Type material should be compared with Scheuer's (1988) collections to assess the conspecificity.

● ***Naeviella paradoxa*** (Rehm) Clem.; Défago 1968 as *Eupropolella p.*, Nannfeldt 1982. — Scheuer (1988, as *'Naeviella* aff. *paradoxa'*) also recorded a very similar fungus with slightly shorter ascospores discovered in two collections on *Elyna myosuroides* (Vill.) Fritsch. Asci and ascospores from both collections on this host were figured by Scheuer (1988, Taf. 5, Fig. b and c). Unfortunately, **Fig. c** was erroneously labelled *Naeviella volkartiana*. It shows ***'Naeviella* aff. *paradoxa'*** on *Elyna myosuroides*.

● ***Naeviella poeltiana*** Scheuer 1988. — This is turning out to be a problematic taxon because of the apparent differences in the intensity of the hemiamyloid (IKI+ red) reaction of the apical ring between different collections. According to Nograsek & Matzer (1994), the asci in their collections of *N. poeltiana* on *Carex firma* Mygind show an IKI– apical ring. On the other hand, a collection on *Luzula alpino-pilosa* (Chaix) Breistr. showed a much more intense IKI+ red reaction than the type on *Carex ferruginea* Scop. (erroneously the iodine reaction of the collection on *Luzula alpino-pilosa* was cited as IKI+ blue by Nograsek & Matzer 1994).

● *'Leptosphaeria' caricis-firmae* Petrak 1947; present name: ***Phaeosphaeria caricis-firmae*** (Petr.) Leuchtmann & Schmid-Heckel in Schmid-Heckel 1988. — Apparently the new combination and re-description of Petrak's species were published a bit too late to be included in the monograph by Shoemaker & Babcock (1989). These authors described a very similar taxon, *Ph. exarata* Shoemaker & Babcock, found on *Carex sempervirens* Vill. in Switzerland. According to their description and illustrations, it is most probably conspecific with *Ph. caricis-firmae*.

Nograsek (1990) pointed out two differences between our material (mainly on *Carex firma* Mygind, one collection on *Carex atrata* L.) and Petrak's protologue. Firstly, Petrak emphasized the parasitic lifestyle of the fungus, which should grow mainly on dead leaf tips, causing a dieback downward to the leaf base. Secondly, Petrak did not mention the characteristic longitudinally striate ornamentation of the ascospore wall. However, the type specimen in W shows that well-developed ascomata can also be found on dead (but still undecayed) leaves and that mature ascospores are uniformly striate.

● '*Phaeosphaeria eustoma* (Fuckel) L. Holm 1957 sensu lato'. — Both collections described under this name by Scheuer (1988) do not belong to *Ph. eustoma* s.str. as delimited in the revision by Shoemaker & Babcock (1989). The taxonomic positions of Scheuer's '*Phaeosphaeria eustoma* I' and '*Phaeosphaeria eustoma* II' (both on *Juncus effusus* L.) remain unclear. It should be noted here that they apparently belong in two different subgenera described by Shoemaker & Babcock (1989): '*Phaeosphaeria eustoma* I' would key out in subgen. *Phaeosphaeria* (probably close to *Phaeosphaeria eustoma* s.str.), '*Phaeosphaeria eustoma* II' resembles *Phaeosphaeria moravica* Shoemaker & Babcock (1989) and *Phaeosphaeria juncinella* (Mouton) Shoemaker & Babcock (1989) in subgen. *Fusispora*. On the other hand, the collections published by Magnes & Hafellner (1991, on *Equisetum fluviatile* L. and *Carex rostrata* Stokes ex With.) are apparently conspecific with *Phaeosphaeria eustoma* s.str.

● *Phaeosphaeria herpotrichoides* (De Not.) L. Holm 1957 sensu lato. — Shoemaker & Babcock (1989) split up the former collective species *Ph. herpotrichoides*. The three collections tentatively identified by Scheuer (1988) as Eriksson's (1967) 'form 5a' and 'form 5b', can now be accommodated in ***Phaeosphaeria erikssonii*** Shoemaker & Babcock (1989). However, the asci and ascospores of the collection on *Carex leporina* L. are larger than in typical *Ph. erikssonii* and often show an additional septum in the lower hemispore.

The species in Scheuer's unilocal lowland collections on *Carex elata* All., *C. vesicaria* L. and *Scirpus radicans* Schkuhr could not be assigned to any of Eriksson's (1967) 'forms', nor to any of Shoemaker & Babcock's (1989) taxa (Scheuer 1988, Taf. 27, Fig. f).

● ***Phaeosphaeria juncicola*** (Rehm) L. Holm 1957; Leuchtmann 1984, Schmid-Heckel 1988, Shoemaker & Babcock 1989. — The isotype specimen of *Ph. juncicola* in GZU (Rehm: Ascomycetes exs. no. 533, as *Leptosphaeria juncicola*) agrees with the description of Holm (1957) or Leuchtmann (1984) who gave ascospore measurements of 30-46 × 4-4.5 μm. The ascospores from the isotype in FH figured by Shoemaker & Babcock (1989) are apparently shorter and slightly broader, 30-35 × 4.5-5.5 μm, just like in the original drawing by Rehm preserved with the type specimen in S. However, when the type specimen from S was examined, it was found that part of the ascomata in the type collection are slightly immature and that the ascospores drawn by Shoemaker & Babcock (1989) and Rehm apparently represent the lower range of variation.

- *Phaeosphaeria juncina* (Auersw. ap. Rabenh.) L. Holm 1957. — Shoemaker & Babcock (1989) examined type material of this species and found that the ascospores have longitudinally striate walls and are also much smaller than in the species treated under the name *Ph. juncina* by Holm (1957), Hedjaroude (1969), Leuchtmann (1984), and Scheuer (1988). Shoemaker & Babcock (1989) re-separated all taxa synonymized by these authors under *Ph. juncina*. Now Scheuer's (1988) collections key out under ***Phaeosphaeria petkovicensis*** (Bub. & Ranoj. in Ranoj.) Shoemaker & Babcock (1989).

- ***Phomatospora berkeleyi*** Sacc. sensu lato; Arx & Müller 1954, Webster 1955, Nograsek 1990, Magnes & Hafellner 1991. — The small-spored *Phomatospora* species usually identified as *Ph. berkeleyi* are in need of revision. The presence or absence of gelatinous coats or terminal appendages of the ascospore wall may provide some useful morphological characters, but ascospore proportions may also be important. For example, the fungus on *Carex firma* Mygind with conspicuously broader ascospores figured by Scheuer (1988, Taf. 15, Fig. e) and Nograsek (1990) is apparently not conspecific with *Ph. berkeleyi*.

- ***Phomatospora radegundensis*** Scheuer 1988. — It must be noted here that the **paratype** collection (same locality as holotype, 24.05.1987) was erroneously termed 'Isotypus' after the Latin diagnosis and 'Topotypus' after the German description. At first this species was rather isolated within the genus, but two years later Nograsek (1990) described a very similar species found on *Carex firma* Mygind and *Poa alpina* L., *Ph. admontensis*. However, the type species of the genus, *Ph. berkeleyi*, and nearly all other currently accepted *Phomatospora* species have the typical striate ascospore wall ornamentation.

- ***Phomatospora striatigera*** Scheuer 1988. — Fallah & Shearer (1998) re-examined the holotype of *Ph. striatigera* and added some important observations to the original description and illustrations. The ascospores show bipolar rounded gelatinous caps, just like *Ph. berkeleyi* s.str. (Fallah & Shearer 1998, holotype), *Ph. aquatica* Minoura & Muroi (1978), and *Ph. bellaminuta* Kohlmeyer & al. (1995). When mounted in lactic acid with azure A for several hours, the guttules in the ascospores become more distinct in shape and move slightly away from the centre at which time a septum becomes clearly visible in the middle of the ascospore. The majority of ascospores examined from the holotype were one-septate.

Ph. striatigera remains an unilocal species so far. The two less certain records given by Scheuer (1988) probably belong to an undescribed taxon with smaller ascomata and ascospores.

- ***Phyllachora therophila*** (Desm.) Arx & Müller 1954. — Magnes & Hafellner (1991) pointed out that Scheuer (1988) had overlooked the small IKI+ red (hemi-amyloid) apical ring of the ascus in this species. The same mistake was made in the key (Scheuer 1988, Key A, 8a/b). Therefore *Ph. therophila* would key out under 8a, together with the genus *Physalospora*. Barr (1994) accommodated *Ph. therophila* in *Phomatospora* again, as *Ph. therophila* (Desm.) Sacc.

- ***Physalospora alpestris*** Niessl; Arx & Müller 1954, Schmid-Heckel 1988, Nograsek 1990. — The range of variation in peridium pigmentation and ascus/ascospore size among the different collections indicated by Scheuer (1988) has not yet been evaluated. Nograsek (1990) noted that the apical ring of the asci shows an IKI+ red (hemiamyloid) reaction (IKI+ blue after pretreatment with KOH).

- ***Physalospora moutoni*** Sacc. & P. Syd., Syn. *Ph. palustris* Mout. (non *Ph. palustris* (Mont.) Sacc.); Saccardo & Sydow 1902 (erroneously cited as 'Saccardo 1902' by Scheuer 1988: 157). — Magnes & Hafellner (1991) recorded a similar species, *Ph. aquatica* Ingold (1955). The differences between *Ph. moutoni* and *Ph. aquatica* would require a more detailed study, including type material, because the wide range of variation assumed by Scheuer (1988) would include this collection of *Ph. aquatica* in *Ph. moutoni*. However, Magnes & Hafellner (1991) emphasize the occurrence of septate, branched periphyses as a diagnostic character of *Ph. aquatica*. For the time being, this may be regarded as an acceptable solution in such an imperfectly known genus. Just like in *Ph. alpestris*, the iodine reactions of the asci should be tested on a broader basis. Magnes & Hafellner (1991) noted that the iodine reaction of the apical ring in *Ph. aquatica* was euamyloid (IKI+ blue).

- `PLEOSPORA Rabenh. ex Ces. & De Not.`

  `Fam. Pleosporaceae; Crivelli 1983 ...`

This is the correction of a typographic error in the heading of Scheuer's (1988) treatment of *Pleospora* spp.

- *Pleospora scirpi* (Rabenh.) Ces. & De Not. — Shoemaker & Babcock (1992) revived the genus *Macrospora* Fuckel for *P. scirpi* and its allies. They also demonstrated that Crivelli's (1983) concept of the species was apparently too broad and separated two taxa united by him, viz. *Macrospora scirpi* (Fr. ex Rabenh.) Shoemaker & Babcock and *M. scirpicola* (DC.: Fr.) Fuckel. The two collections on *Schoenoplectus lacustris* (L.) Palla listed by Scheuer (1988) belong to ***Macrospora scirpicola***.

- *Psilachnum eburneum* (Rob. ap. Desm.) Baral in Baral & Krieglsteiner 1985. — This was a misidentification based on immature apothecia of ***Psilachnum acutum*** (Velen.) Svrček still lacking the characteristic lanceolate paraphyses.

- *'Rhytisma' juncicola*: see under ***Lophodermium***.

- ***Taphrophila cornu-capreoli*** Scheuer 1988. — Scheuer (1989, 1991b) added some important features to the original description, e.g., the presence of pseudoparaphyses in mature ascomata. Therefore it became obvious that *Taphrophila* Scheuer does not belong in the Herpotrichiellaceae, where it was tentatively placed by Scheuer in 1988, but to the *Tubeufiaceae*, close to *Tubeufia* Penzig & Sacc. s.l. as outlined by Barr (1980). Scheuer (1991b) found a hyphomycetous anamorph in pure cultures derived from single ascospores of British material. It was assigned to the form genus *Mirandina* Arn. ex Mats. (B. C. Sutton, pers. comm.). In addition, it should be noted that the mycelium is not only superficial but also intramatrical (Scheuer 1991b).

A typographic error occurred in the Latin diagnosis of the genus. The corrected passage reads as follows:

> `Mycelium superficiale, brunneum ...`

- ***Trichonectria hyalocristata*** Scheuer 1988. — Unfortunately two mistakes occurred in the original description. Firstly, the author wrote 'Paraphyses in peritheciis maturis sparsissimae, indistinctae'. If any remnants of interascal hyphae are found in a Hypocrealean ascoma, they should normally be interpreted as pseudoparaphyses, not as paraphyses. Secondly, an important passage of five words was missing in the German version of the original description which should read:

> `... Pseudoparaphysen in reifen Fruchtkörpern sehr` **`spärlich und undeutlich. - Asci sehr`** `zahlreich, ± spindelig, ...`

This minute species was also found in Britain (Scheuer 1989).

- *Wentiomyces molarifer* Scheuer 1988. — Barr (1997) suggested the abandonment of the problematic name *Wentiomyces* Koord. and reinstated the genera *Raciborskiomyces* Siemaszko and *Neocoleroa* Petr. instead. The currently accepted name of *W. molarifer* is ***Neocoleroa molarifera*** (Scheuer) M.E. Barr.

- *'Wettsteinina* cf. *niesslii'* E. Müller 1950. — According to a type study by Scheuer (1995), the fungus described by Scheuer (1988) under this name is definitely not conspecific with *Wettsteinina niesslii* s.str. Apparently it represents a new species closely related to *Didymella caricis* and *W. niesslii* s.str., but the present specimens are too scant to serve as type material. Although it may be assumed that these three species are congeneric, they are not typical representatives of the genus *Wettsteinina*, at least not if compared to the type species, *Wettsteinina gigaspora* Höhn. The same applies for the genera *Didymella* and *Massarina*. The choice of genera to accommodate such species is very limited at the moment, therefore no new combinations are proposed here.

- *SPECIES INCERTAE SEDIS 1* and *SPECIES INCERTAE SEDIS 2* (Scheuer 1988). — These two species belong in the genus ***Ceramothyrium*** Petr., maybe close to *Ceramothyrium carniolicum* Constantinescu & al. (1989).

Finally, it must be noted that an incorrect date for the book by Breitenbach & Kränzlin (1984) occurred in the reference list (Scheuer 1988, p. 260) and in the text (p. 53, p. 192). The year of publication was erroneously given as 1981 instead of **1984**.

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Literature cited

Aptroot A. 1998. A world revision of *Massarina* (Ascomycota). – Nova Hedwigia 66(1-2): 89-162.

Arx J.A. von & Müller E. 1954. Die Gattungen der amerosporen Pyrenomyceten. – Beiträge zur Kryptogamenflora der Schweiz 11(1), 434 pp.

Baral H.O. 1987. Lugol's solution/IKI versus Melzer's reagent: hemiamyloidity, a universal feature of the ascus wall. – Mycotaxon 29: 399-450.

Baral H.O. 1994. Comments on the 'Outline of the ascomycetes - 1993'. – Systema Ascomycetum 13: 113-128.

Baral H.O. & Krieglsteiner G.J. 1985. Bausteine zu einer Askomyzeten-Flora der BR Deutschland: In Süddeutschland gefundene inoperculate Discomyzeten. – Beihefte zur Zeitschrift für Mykologie 6: 1-160.

Barr M.E. 1968. The Venturiaceae in North America. – Canadian Journal of Botany 46: 799-864.

Barr M.E. 1980. On the family Tubeufiaceae (Pleosporales). – Mycotaxon 12(1): 137-167.

Barr M.E. 1987. Prodromus to Class Loculoascomycetes. – Amherst, Massachusetts. 168 pp.

Barr M.E. 1989. The genus *Chaetomastia* (Dacampiaceae) in North America. – Mycotaxon 34(2): 507-515.

Barr M.E. 1990. Melanommatales (Loculoascomycetes). In: North American Flora. Series II, Part 13: 1-129. – New York.

Barr M.E. 1992. Notes on the Lophiostomataceae. – Mycotaxon 55: 191-221.

Barr M.E. 1994. Notes on the Amphisphaeriaceae and related families. – Mycotaxon 51: 191-224.

Barr M.E. 1997. Notes on some 'dimeriaceous' fungi. – Mycotaxon 64: 149-171.

Boudier E. 1905-1910. Icones Mycologicae. Tome III. Planches 422 - 600. – Paris.

Breitenbach J. & Kränzlin F. 1984. Pilze der Schweiz. I. Ascomyceten (Schlauchpilze). – Luzern. 313 pp.

Constantinescu O., Holm K. & Holm L. 1989. Teleomorph-anamorph connections in Ascomycetes. 1 - 3. *Stanhughesia* (Hyphomycetes) new genus, the anamorph of *Ceramothyrium*. – Studies in Mycology 31: 69-84.

Crivelli P.G. 1983. Ueber die heterogene Ascomyceten-Gattung *Pleospora* Rabh.; Vorschlag für eine Aufteilung. – Dissertation ETH Zürich Nr. 7318, 213 pp.

Défago G. 1968. Les *Hysteropezizella* von Höhnel et leurs formes voisines (Ascomycetes). – Sydowia 21: 1-76.

Dennis R.W.G. 1949. A revision of the British Hyaloscyphaceae with notes on related European species. – Mycological Papers 32, 97 pp.

Dennis R.W.G. 1980. New or critical fungi from the Highlands and Islands. – Kew Bulletin 35: 343-361.

Dennis R.W.G. & Spooner B.M. 1992. The Fungi of North Hoy, Orkney - I. – Persoonia 14(4): 493-507.

Dennis R.W.G. & Spooner B.M. 1993. The Fungi of North Hoy, Orkney - II. – Persoonia 15(2): 169-177.

Eriksson O.E. 1967. On graminicolous pyrenomycetes from Fennoscandia. II. Phragmosporous and scolecosporous species. – Arkiv för Botanik 6(9): 381-440.

Fallah P.M. & Shearer C.A. 1998. Freshwater Ascomycetes: *Phomatospora* spp. from lakes in Wisconsisn. – Mycologia 90(2): 323-329.

Hedjaroude G.A. 1969. Études taxonomiques sur les *Phaeosphaeria* Miyake et leurs formes voisines (Ascomycetes). – Sydowia 22: 57-107.

Hein B. & Scheuer Ch. 1986. Neue Dermateaceen (Ascomycetes) auf Gramineen, Cyperaceen und Juncaceen aus den Alpen. – Sydowia 38: 125-135.

Höhnel F. von 1926. Über die Gattung *Pezizella* Fuckel. – Mitteilungen aus dem Botanischen Institut der Technischen Hochschule in Wien 3: 54-80.

Holm L. 1957. Études taxonomiques sur les Pléosporacées. – Symbolae Botanicae Upsalienses 14(3), 188 pp.

Holm L. & Holm K. 1988. Studies in the Lophiostomataceae, with emphasis on the Swedish species. – Symbolae Botanicae Upsalienses 28(2), IV + 50 pp.

Hütter R. 1958. Untersuchungen über die Gattung *Pyrenopeziza* Fuck. – Phytopathologische Zeitschrift 33(1): 1-54.

Ingold C.T. 1955. Aquatic ascomycetes: Further species from the English Lake District. – Transactions of the British Mycological Society 38: 157-168.

Karsten P.A. 1869. Monographia Pezizarum fennicarum. – Notiser ur Sällskapets pro Fauna et Flora Fennica Förhandlingar 10, N.S. 7: 99-206.

Kohlmeyer J., Volkmann-Kohlmeyer B. & Eriksson O.E. 1995. Fungi on *Juncus roemerianus*. 3. New Ascomycetes. – Botanica Marina 38: 175-186.

Leuchtmann A. 1984. Über *Phaeosphaeria* Miyake und andere bitunicate Ascomyceten mit mehrfach querseptierten Ascosporen. – Sydowia 37: 75-194.

Magnes M. & Hafellner J. 1991. Ascomyceten auf Gefäßpflanzen an Ufern von Gebirgsseen in den Ostalpen. – Bibliotheca Mycologica 139, II + 182 pp., mit 53 Abbildungen.

Minoura K. & Muroi T. 1978. Some freshwater Ascomycetes from Japan. – Transactions of the Mycological Society of Japan 19: 129-134.

Müller E. 1950. Die schweizerischen Arten der Gattung *Leptosphaeria* und ihrer Verwandten. – Sydowia 4: 185-319.

Müller E. 1951. Neue, alpine Arten der Gattung *Leptosphaeria*. – Sydowia 5: 49-55.

Müller E. 1977. Zur Pilzflora des Aletschwaldreservats. – Beiträge zur Kryptogamenflora der Schweiz 15(1), 125 pp.

Müller E. & Arx J.A. von 1962. Die Gattungen der didymosporen Pyrenomyceten. – Beiträge zur Kryptogamenflora der Schweiz 11(2), 922 pp.

Müller E., Hütter R. & Schüepp H. 1964. Über einige finnische Discomyceten. – Archivum Societatis zoologicae botanicae Fennicae 'Vanamo' 18: 189-193.

Munk A. 1957. Danish Pyrenomycetes. – Dansk Botanisk Arkiv 17(1), 491 pp.

Nannfeldt J.A. 1976. *Micropeziza* Fuck. and *Scutomollisia* Nannf. nov. gen. (Discomycetes inoperculati). – Botaniska Notiser 129: 323-340.

Nannfeldt J.A. 1982. *Naeviella* (Rehm) Clem., a resurrected genus of inoperculate discomycetes, and some remarks on ascospore symmetry. – Sydowia 35: 162-175.

Nauta M.M. & Spooner B.M. 1999. British Dermateaceae: 1. Introduction. – Mycologist 13(1): 3-6.

Nograsek A. 1990. Ascomyceten auf Gefäßpflanzen der Polsterseggenrasen in den Ostalpen. – Bibliotheca Mycologica 133, IV + 271 pp., mit 149 Abbildungen und 9 Photos im Anhang.

Nograsek A. & Matzer M. 1991. Nicht-pyrenokarpe Ascomyceten auf Gefäßpflanzen der Polsterseggenrasen. I. Arten auf Dryas octopetala. – Nova Hedwigia 53 (3-4): 445-475.

Nograsek A. & Matzer M. 1994. Nicht-pyrenokarpe Ascomyceten auf Gefäßpflanzen der Polsterseggenrasen. II. Arten auf Cyperaceae und Poaceae. – Nova Hedwigia 58(1-2): 1-48.

Petrak F. 1947. Kleine Beiträge zur Pilzflora von Tirol. – Sydowia 1: 313-327.

Raitviir A. 1969. Discomycetes of Middle Asia. I. Descriptions of some new Helotiales. – Eesti NSV Teaduste Akadeemia toimetised, biol. seer. 18: 66-69.

Raitviir A. 1970. Synopsis of the Hyaloscyphaceae. – Scripta Mycologica 1, 115 pp.

Raitviir A. 1978. K sistematike roda *Cistella* i blizkich k nemu taksonov. – Scripta Mycologica 8: 147-159.

Raitviir A. & Sacconi S. 1991. Some interesting Hyaloscyphaceae from North Italy. 2. – Mycologia Helvetica 4(2): 161-168.

Rehm H. '1896'. Die Pilze Deutschlands, Oesterreichs und der Schweiz. III. Abtheilung: Ascomyceten: Hysteriaceen und Discomyceten. In: Dr. L. Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz. Zweite Auflage. Erster Band: Pilze. – Leipzig.

Remler P. 1979. Ascomyceten auf Ericaceen in den Ostalpen. – Bibliotheca Mycologica 68, II + 321 pp.

Saccardo P.A. 1878. Fungi Veneti novi vel critici vel Mycologiae Venetae addendi. – Michelia 1: 361-445.

Saccardo P.A. 1884. Conspectus generum Discomycetum hucusque cognitorum. – Botanisches Centralblatt 18: 213-256.

Saccardo P.A. & Sydow P. 1902. Sylloge fungorum omnium hucusque cognitorum. XVI. Supplementum universale. Pars V. – Padova.

Scheuer Ch. 1988. Ascomyceten auf Cyperaceen und Juncaceen im Ostalpenraum. – Bibliotheca Mycologica 123, IV + 274 pp., mit 5 Abbildungen im Text und 32 Tafeln im Anhang.

Scheuer Ch. 1989. Two small ascomycetes on *Carex* new to Britain. – Mycological Research 93(1): 115-118.

Scheuer Ch. 1991a. *Massarina tetraploa* sp. nov., the teleomorph of *Tetraploa aristata*. – Mycological Research 95(1): 126-128.

Scheuer Ch. 1991b. *Taphrophila* (Dothideales: Tubeufiaceae) and two species of *Tubeufia* with dark setae. – Mycological Research 95(7): 811-816.

Scheuer Ch. 1995. Lectotypification of *Wettsteinina niesslii* (Dothideales s.l., Ascomycetes). – Mycotaxon 54: 173-178.

Scheuer Ch. 1997. Dupla Fungorum (1997), verteilt vom Institut für Botanik der Universität Graz (GZU). – Fritschiana 9: 39-61.

Scheuer Ch. & Poelt J.(†) 1997. Mycotheca Graecensis, Fasc. 3 - 7 (Nr. 41-140). – Fritschiana 9: 1-37.

Schmid-Heckel H. 1988. Pilze in den Berchtesgadener Alpen. – Nationalpark Berchtesgaden, Forschungsbericht 15, 136 pp.

Shoemaker R.A. & Babcock C.E. 1989. *Phaeosphaeria*. – Canadian Journal of Botany 67: 1500-1599.

Shoemaker R.A. & Babcock C.E. 1992. Applanodictyosporous Pleosporales: *Clathrospora*, *Comoclathris*, *Graphyllium*, *Macrospora*, and *Platysporoides*. – Canadian Journal of Botany 70: 1617-1658.

Spooner B.M. & Dennis R.W.G. 1986. New or Interesting Ascomycetes from the Highlands and Islands. – Sydowia 38: 294-316.

Svrček M. 1978. New or less known Discomycetes. – Česká Mykologie 32(3): 157-160.

Sydow H. 1921. Novae fungorum species. XVII. – Annales Mycologici 19: 304-309.

Tomilin B.A. 1979. Opredelitel gribow roda *Mycosphaerella* Johanson. – Leningrad. 318 pp.

Walker J. 1980. *Gaeumannomyces*, *Linocarpon*, *Ophiobolus*, and several other genera of scolecospored ascomycetes and *Phialophora* conidial states, with a note on hyphopodia. – Mycotaxon 11: 1-129.

Webster J. 1955. Graminicolous pyrenomycetes. V. Conidial states of *Leptosphaeria michotii*, *L. microscopica*, *Pleospora vagans*, and the perfect state of *Dinemasporium graminum*. – Transactions of the British Mycological Society 38: 347-365.

Wehmeyer L.E. 1961. A world monograph of the genus *Pleospora* and its segregates. – Ann Arbor, Michigan. XII + 451 pp.

MYCOTAXON

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A NEW FOLIICOLOUS LACHNUM FROM TAIWAN

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ABSTRACT

A new foliicolous species of *Lachnum* with red exudate on the tips of the hairs and long, narrow, cylindrical spores with a slight swelling in the central portion, is described as *L. fushanensis*. The type is from the Fushan Botanical Garden, Taiwan, R. O. C. Additional collections are from the Philippines and Indonesia.

Key words: *Lachnum*, Taiwan, Philippines, Indonesia, foliicolous

INTRODUCTION

In April of 1998, a collecting trip to the Fushan Botanical Garden, Taiwan was headed by M. L. Wu and J. H. Haines. Among the many interesting fungi collected by the authors and their party in this beautifully preserved, Asian forest was a striking, foliicolous *Lachnum* with a fringe of ruby red particles on the tips of hairs and long, very slender, cylindrical spores with a slightly enlarged mid section. This species differs from all lachnums known to the authors from Taiwan (Wu, 1995; Wu *et al*., 1998) and other tropical areas (Haines & Kaneko, 1984; Sharma, 1986; Spooner, 1987; Haines, 1992; Cantrell & Haines, 1997; Zhuang & Wang, 1998, Zhuang 1998). Two additional specimens of the same species from Indonesia and the Philippines were located among the K. P. Dumont collections at CUP.

DESCRIPTION

Lachnum fushanensis M. L. Wu and J. H. Haines **sp. nov.** (Figs.1- 6)
Apothecium usque ad 0.8 mm diametro, in laminis foliorum dejectorum arborum deciduarum, cyathiforme vel salviform, pilis latericiis materiae resinaceae rubineae ad apicem vestitum. Pili usque ad 70 µm, plerumque

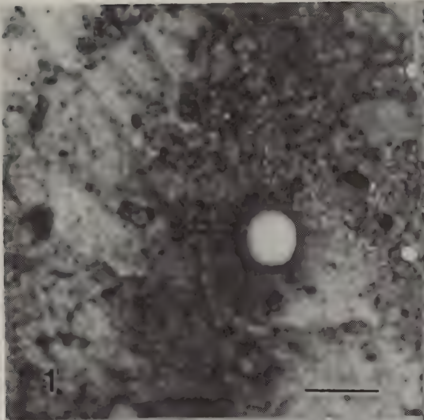
40-60 X 3-5 µm, irregulariter cylindrici, tentuitunicati, granulati. Ascosporae (32-)35-38(-41) X 0.8-1.3 µm, cylindricae, parte media subamplificata. Paraphyses lanceolatae, asciusque ad 5 µm superantes.

Apothecia up to 0.8 mm diam., scattered on the lamina of dicotyledonous leaves, goblet-shaped to salviform, stipitate, covered with reddish-brown hairs tipped with ruby-red resin-like matter. Disc cream-yellow, slightly concave to flat and exposed, even when dry. Stipe slender, shorter than or equal to the diameter of the disc, covered with hairs of lighter color than those at the margin. **Ectal excipulum** *textura prismatica* composed of short, slightly thick-walled cells, 10-20 X 5-8 µm with walls ca. 1.0 µm thick. **Hairs** up to 70 µm, mostly 40-60 X 3-5 µm, unevenly cylindrical, occasionally with a slightly enlarged apex, 0-2-septate, thin-walled, flexuous, roughened with relatively coarse, vertically elongated granules ca. 1.0 µm high, light reddish brown, capped with dark red resin-like, water soluble, matter which turns dark brown on drying. **Asci** (42-)48-53(-54) X 2.9-3.9 µm, cylindric with a short, tapered base and a tapered apex, crozier present at the base, pore J+ when stained with Melzer's reagent. **Ascospores** (32-)35-38(-41) X 0.8-1.3 µm, cylindrical with rounded ends ca. 0.6-0.8 µm diam., enlarged in the central portion, straight or sometimes with a distinct bend in one end, otherwise bipolar in symmetry, non-septate, without conspicuous inclusions, fasciculate in the ascus. **Paraphyses** 2-3 µm diam. at the widest point, narrowly lanceolate with a short, blunt to acuminate tip, equal to or exceeding the asci by up to 5 µm.

Holotypus: REPUBLIC OF CHINA, Taiwan, Ilan, Fushan Botanical Garden, along the forest trail across the road from the Center for Forestry Education, alt. 650 m, on the dead leaves of unidentified dicotyledonous tree, M. L. Wu, J. H. Haines, C. M. Chou and Y. Y. Wu, 5-IV-1998, *M. L. Wu 980405-39,* (TMTC); Isotype in (NYS)

Etymology: From Fushan, the name of the type locality.

Figs.1-6. *Lachnum fushanensis.* 1. Apothecium. Bar = 1 mm; 2. Excipular hairs. Bar = 10 µm. 3. Marginal hairs capped with resin. Bar = 7.5 µm. 4. Ectal exciple. Bar = 12 µm. 5. Asci and paraphyses. Bar = 7.7 µm. 6. Ascospore. Bar = 10 µm. (Figs. 3-6 with Nomarski microscopy)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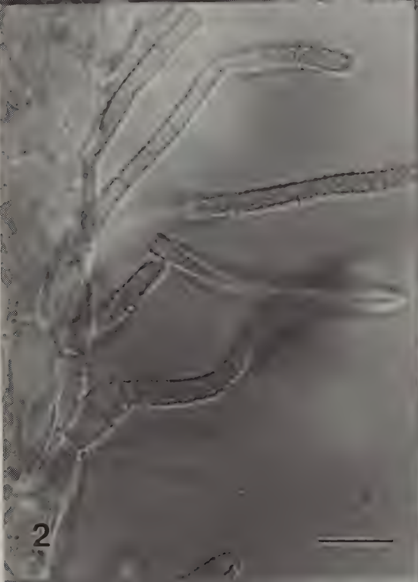
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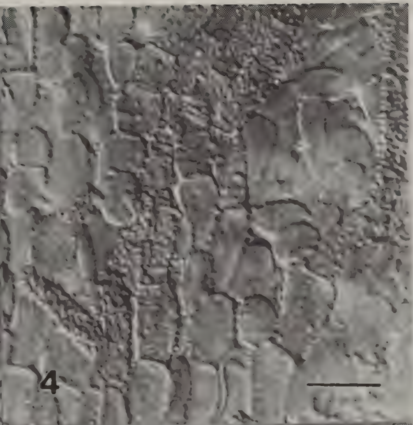
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Additional material studied: **Indonesia**, Java, Tjibodas, along trail to Mt. Gedeh, on leaves of *Viburnum* sp. 5-I-1967, K. P. Dumont & Nurta, SA-3036 (CUP); **Philippines**, Palawan, Inagawan sub-colony Penal Institute, Km 54 from Puerta Princesa, on leaves of *Dipterocarpus* sp., 6-X-1966, K. P. Dumont & J. V. Pancho, SA-1871 (CUP).

DISCUSSION

Although there is already a number of long-spored, foliicolous lachnums described from tropical regions, (Cantrell & Haines, 1997; Haines & Kaneko, 1984; Haines, 1992; Raitviir, *et al.*, 1985; Spooner, 1987; Zhuang & Wang, 1998) the present species appears to be new. *Lachnum fushanensis* differs from all known lachnums in its very narrow, cylindrical spores with a swollen central region which resembles a snake after a large meal and its red resin-like deposits at the tips of its pigmented, marginal hairs. *Lachnum albidulum* (Penz. & Sacc.) M. P. Sharma, *L. confertum* Spooner, *L. haematinum* J. H. Haines, *L. nipponicum* J. H. Haines & S. Kaneko, and *L. victoriani* Cantrell & J. H. Haines all have shorter, and usually fusoid, spores. *Erinella guaranitica* (Speg.) Pat. & Gaillard, and *L. mapirianum* (Pat. & Gaillard) M. P. Sharma differ in having white hairs and *L. darjeelingense* Raitv., Thind & R. Sharma is similar in color but has acicular spores and lacks resin on the hairs. The Philippine and Indonesian collections in CUP were examined by the junior author previously, but neither of them was suitable for a type specimen. SA-3036 from Indonesia is an old, partially degraded specimen while SA-1871 from the Philippines is immature and does not yet show the swelling in the spores, but the authors are confident that they are conspecific with the type of *L. fushanensis*. It is interesting that each of the three collections is not only on a different host, but in all probability on plants representing different plant families.

ACKNOWLEDGEMENTS

The senior author wishes to thank the Council of Agriculture, R. O. C. for financial support [grant no. 87-AST-I, II-FCD-04(6)10] for this study. The junior author wishes to thank the National Science Council of the R. O. C. for supporting travel and field trip expenses (grant no. 87-2912-I-133-292-A2). We thank Miss Chi-Mou Chou and Yu-Yan Wu from Taipei Municipal Teachers' College for preparing photographs, Dr. Charles Sheviak for providing the Latin diagnosis, and Dr. Brian Spooner for serving as presubmission reviewer. We also wish to thank Dr. Kent Dumont and the National Science Foundation that supported him for the collecting he did many years ago which still yields valuable information on tropical discomycetes.

REFERENCES

Cantrell, S. A. and J. H. Haines. 1997. New red species of Lachnum from the tropics. Mycol. Res. 101: 1081-1084.

Haines, J. H., 1992. Studies in the Hyaloscyphaceae VI: the genus Lachnum (ascomycetes) of the Guayana Highlands. Nova Hedwigia 54: 97-112.

Haines, J. H. and S. Kaneko. 1984. A new foliicolous Lachnum from Japan. Trans. Mycol. Soc. Japan 25: 237-242.

Raitviir, A., K. S. Thind and Sharma, M. P. 1985. Four new species of Helotiales from the Eastern Himalayas (India). Eesti Teaduste Akad. Toim. Biol. 34: 228.

Sharma, M. P. 1986. Indian Hyaloscyphaceae. Nova Hedwigia 43: 38-422.

Spooner, B. M. 1987. Helotiales of Australasia: Geoglossaceae, Orbiliaceae, Sclerotiniaceae, Hyaloscyphaceae. J. Cramer. 771 pp.

Wu, M. L. 1995. Studies on the saprophytic ascomycetes from northern mountain area of Taiwan. I-Shan Pub. Co. 75 pp.

Wu, M. L., J. H. Haines and Y. Z. Wang. 1998. New species and records of Lachnum from Taiwan. Mycotaxon 67: 341-354.

Zhuang, W. Y. 1998. Discomycetes of Tropical China. III Hyaloscyphaceous fungi from tropical Guangxi. Mycotaxon 69: 359-376.

Zhuang, W. Y. and Z. Wang. 1998. Discomycetes of tropical China. I. Collections from Hainan Island. Mycotaxon 67: 21-32.

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NEW SPECIES OF XANTHOPARMELIA (LICHENIZED ASCOMYCOTINA, PARMELIACEAE) FROM SOUTH AFRICA

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ABSTRACT : The following new species are described: *Xanthoparmelia afroincerta* Elix, *X. domokosioides* Elix & Nash, *X. fumarafricana* Elix, *X. knoxii* Elix, *X. maculodecipiens* Elix, *X. magnificans* Elix, *X. multiacida* Elix and *X. squamatica* Elix & Nash. *Xanthoparmelia domokosioides* was also found to occur in Mexico.

Introduction

As a result of further study of the lichen family Parmeliaceae in South Africa (Elix 1997, 1999; Elix *et. al.* 1999; Nash & Elix 1987), I am describing a further 8 new species. Throughout the present work chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson *et al.* 1981; Culberson & Johnson 1982; Elix & Ernst-Russell 1993; Elix *et al.* 1988), high performance liquid chromatography (Elix *et al.* 1997; Feige *et al.* 1993) and comparison with authentic samples.

Xanthoparmelia afroincerta Elix, sp. nov. Fig. 1

Differt a *Xanthoparmelia incerta* laciniis di- vel trichotomis ramosis, teretisque vel subteretisque.

Type: Republic of South Africa. Natal: Royal Natal National Park, hill between Mont-aux-Sources and Chain Ladder, 28°45'S, 28°53'E, *ca.* 3050 m, on S-exposed rocks, *D. Treibel & G. Rambold 7032*, 13 March 1990; holo: M; iso: CANB.

Thallus foliose, adnate to tightly adnate, to 9 cm wide. *Lobes* imbricate or contiguous, sublinear to irregular, ±constricted, irregularly branched, 0.8-2 mm wide; laciniate, laciniae narrow, sublinear-elongate, di- or trichotomously branched, terete to subterete, imbricate or subascending, 0.2-0.8 mm wide. *Upper surface* pale yellow-green, darkening with age, flat or convex, shiny but becoming dull, smooth to slightly rugulose, lacking maculae, soredia and isidia. *Medulla* white. *Lower surface* flat or canaliculate in part, smooth, black; rhizines sparse to moderate, simple or ±tufted, black. *Apothecia* not seen. *Pycnidia* common, immersed. *Conidia* bifusiform, 5-7 x 1 μm.

Chemistry: Cortex K-; medulla K+ yellow then dark red, C-, KC-, P+ orange-red; containing usnic acid (major), salazinic acid (major), consalazinic acid (minor), norstictic acid (minor/trace), protocetraric acid (minor/trace).

Morphologically this new species resembles *Xanthoparmelia incerta* (Kurok. & Filson) Elix & J.Johnst., since both are characterized by adnate to tightly adnate thalli, irregular lobes with a black lower surface, the lack of isidia and soredia but with sublinear-elongate laciniae and medullary salazinic acid. However, *X. afroincerta* is distinguished by producing laciniae which are more extensive and markedly revolute with a canaliculate lower surface; the laciniae in *X. incerta* on the other hand are flat and only poorly developed. To date this new species has only been found in the Drakensberg Mountains of Natal and the Orange Free State of the Republic of South Africa.

Specimens Examined (Paratypes)

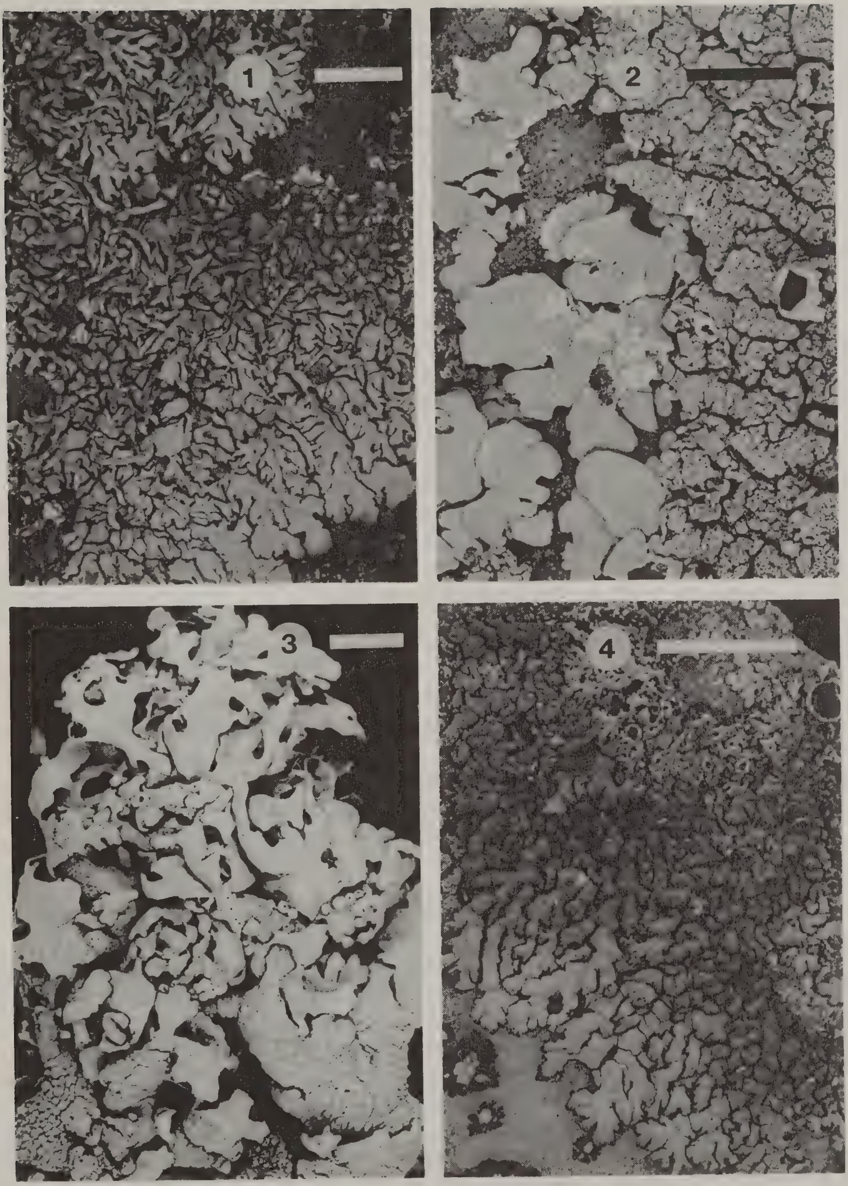
REPUBLIC OF SOUTH AFRICA. Natal: type locality, *D. Treibel & G. Rambold 7029*, 13 March 1990 (ASU).
Orange Free State: Bethlehem, Mont-aux-Sources, Natal Drakensberg, 34 km S of Phuthaditjhaba, Grid 2828 DD, 3050 m, on level basalt rock faces on Tugela River bank, *F. Brusse 5752*, 26 May 1990 (CANB, PRE).

Xanthoparmelia domokosioides Elix & Nash, sp. nov. Fig. 2

Differt a *Xanthoparmelia prodomokosii* lobis latioribus, sporis majoribus et acidum 4-*O*-demethylnotaticum continenti.

Type: Mexico. Sonora: 10 km E of Moctezuma, 29°44'N, 109°44'W, 1020 m, on rhyolite in desert grassland, *T. H. Nash 12450*, 23 Nov. 1975; holo: ASU.

Thallus foliose, adnate to tightly adnate, to 6 cm wide. *Lobes* contiguous, flat, irregular, irregularly branched, 2-5 mm wide; apices rotund. *Upper surface* yellow-green but darkening with age, dull in centre but shiny at lobe apices, emaculate, smooth, becoming irregularly cracked and areolate in centre, without soredia or isidia. *Medulla* white. *Lower surface* shiny, pale ivory to light brown, darker at apices; rhizines moderately dense, simple, slender, concolorous. *Apothecia* sessile to subpedicellate, 2-5 mm wide; disc concave to flat, ultimately undulate-distorted, dark brown; thalline exciple



Figures 1-4. New species of *Xanthoparmelia:* 1, *X. afroincerta* (*F. Brusse 5752* in CANB); 2, *X. domokosioides* (*M. E. Hale 77671* in CANB); 3, *X. fumarafricana* (holotype in M); 4, *X. knoxii* (holotype in M). Scale bar = 5 mm.

smooth then crenate. *Ascospores* ellipsoidal, 8-9 x 5-6 µm. *Pycnidia* rare, immersed. *Conidia* bifusiform, 5-7 x 0.7 µm.

Chemistry. Cortex K-; medulla K-, C-, KC-, P-; containing usnic acid (major), hypoprotocetraric acid (major), 4-*O*-demethylnotatic acid (submajor), conhypoprotocetraric acid (trace).

This species is characterized by the tightly adnate, foliose thallus, the broad lobes with rotund apices, the pale lower surface, the lack of isidia and soredia and the production of hypoprotocetraric and 4-*O*-demethylnotatic acids in the medulla. *Xanthoparmelia domokosioides* resembles *X. prodomokosii* as both have tightly adnate, foliose thalli with a pale lower surface and lack isidia and soredia, but these species differ in medullary chemistry and the width of the lobes. Whereas *X. domokosioides* has broad lobes (2-5 mm wide), larger spores (8-9 x 5-6 µm *cf.* 6-8 x 4-5 µm) and contains hypoprotocetraric and 4-*O*-demethylnotatic acids, *X. prodomokosii* has narrower lobes (1-2.5 mm wide), smaller spores and contains hypoprotocetraric acid and ±various scabrosin derivatives. The latter species appears to be confined to Australia whereas *X. domokosioides* is found in southern Africa and Mexico. *Xanthoparmelia domokosii* is another species with identical chemistry to *X. domokosioides*, but differs in having a much small thallus and narrower lobes with a black lower surface.

Specimens Examined (Paratypes)

REPUBLIC OF SOUTH AFRICA. Cape Province: Nieuwoudtville Nature Reserve outside of Nieuwoudtville off Highway 27, Grid 3119 AC, 800 m, on granite domes and boulders in karoo, *M. E. Hale 72138*, 29.i.1986 (CANB); 12 km north of Jansenville on highway R75, Grid 3224 DC, 600 m, on low outcrops in karoo, *M. E. Hale 77671*, 18.x.1986 (CANB).

Xanthoparmelia fumarafricana Elix, sp. nov. Fig. 3

Differt a *Xanthoparmelia austroafricana* lobis laciniatis et acidum fumarprotocetraricum contineti.

Type: Republic of South Africa. Cape Province: Waboomsberg, *ca.* 30 m below summit, 33°38'S, 20°17'E, *ca.* 1200 m, on stones on the ground, *D. Treibel & G. Rambold 8088*, 31 March 1990; holo: M; iso: CANB.

Thallus foliose, loosely adnate to adnate, firm, coriaceous, to 8 cm wide. *Lobes* imbricate or not, flat, subirregular to sublinear, irregularly branched, 3-10 mm wide; laciniate, laciniae sublinear, narrow, 1-2 mm wide. *Upper surface* yellow-green, darkening with age, shiny but becoming dull, smooth to rugose and wrinkled, weakly white-maculae, lacking soredia and isidia. *Medulla* white. *Lower surface* flat, ±rugulose, pale ivory to tan in the centre, darker grey-brown at the lobe apices; rhizines moderately dense, simple or rarely dichotomously branched, 0.5-1.5 mm long, concolorous. *Apothecia* scattered, substipitate, juvenile, to 1 mm wide. *Ascospores* immature. *Pycnidia* common, immersed. *Conidia* bifusiform, 5-7 x 0.7 µm.

Chemistry: Cortex K-; medulla K+ pale yellow brown, C-, KC-, P+ orange-red; containing usnic acid (major), fumarprotocetraric acid (major), protocetraric acid (minor/trace), unknown (trace).

A loosely adnate species, characterized by the firm, leathery thallus, the broad, ±rugose primary lobes, pale lower surface with some dichotomously branched rhizines and the medullary chemistry. Morphologically this new species resembles *Xanthoparmelia austroafricana* (Stirton) Hale, since both are characterized by thalli with broad irregular, lobes with a pale lower surface, and the absence of isidia or soredia. However, *X. fumarafricana* is distinguished by the broader (2-10 mm *cf.* 2-6 mm wide), laciniate lobes and in the production of fumarprotocetraric acid; the thalli of *X. austroafricana,* on the other hand, are narrower, laciniae are absent or only poorly developed, and the medulla contains protocetraric acid but lacks fumarprotocetraric acid. At present *X. fumarafricana* is only known from the type locality.

Xanthoparmelia knoxii Elix, sp. nov. Fig. 4

Differt a *Xanthoparmelia parvoincerta* superficie effigurata-maculata et acidum norsticticum et acidum connorsticticum continenti.

Type: Republic of South Africa. Cape Province: Klein-Swartberge, Droevlei-Seweweekspoort road, 4 km S of crossing to Gamkapoortdom, waterfall in gorge opposite picnic ground, 33°23'S, 21°25'E, *ca.* 900 m, on large boulders in gorge, *D. Triebel & G. Rambold 7951,* 30 March 1990; holo: M.

Thallus small-foliose to subcrustose, tightly adnate, to 4 cm wide. *Lobes* very rarely imbricate, contiguous, flat, irregular to sublinear, irregularly branched, 0.5-0.8 mm wide. *Upper surface* pale yellow-grey to yellow-brown, dull, strongly effigurate-maculate, rugulose, often developing transverse cracks in older lobes and becoming areolate, lacking soredia and isidia. *Medulla* white. *Lower surface* black, brown towards the lobe apices; rhizines sparse to moderately dense, simple, robust, black. *Apothecia* common, sessile, 0.5-1.2 mm wide; disc concave then ±flat, mid to dark brown; thalline exciple smooth, involute entire, becoming ±crenulate. *Ascospores* 9-12 x 5-7 µm. *Pycnidia* common, immersed. *Conidia* bifusiform, 5-7 x 1 µm.

Chemistry. Cortex K-; medulla K+ red, C-, P+ orange-red; containing usnic acid (minor), norstictic acid (major), salazinic acid (minor), connorstictic acid (trace), unknowns (minor).

This species is characterised by the tightly adnate, small-foliose to subcrustose thallus, the narrow, irregular to sublinear lobes, the markedly effigurate-maculate upper surface, the black lower surface and by the production of norstictic acid and salazinic acid in the medulla. This unique combination of characters distinguish *X. knoxii* from all other species of *Xanthoparmelia* (Hale 1990). Morphologically *X. knoxii* resembles *X. parvoincerta* Elix & J.Johnst., but this species differs in lacking the effigurate maculae, in having separate lobes and in containing salazinic acid and consalazinic acid. At present this new species is known only from the type locality. This species is named in honour of the South African lichenologist, Dr David Knox.

Specimen Examined (Paratype)

REPUBLIC OF SOUTH AFRICA. Type locality, on large boulders in gorge, *D. Triebel & G. Rambold 7953,* 30 March 1990 (CANB).

Xanthoparmelia maculodecipiens Elix, sp. nov. Fig. 5

Differt a *Xanthoparmelia subdecipiens* habitu laxe adnato, superficie maculata et lobis revolutis.

Type: Republic of South Africa. Cape Province: Leeukop (Lion's Head) west of Capetown, NE of summit, 33°56'S, 18°23'E, 669 m, on small rocks, *D. Triebel & G. Rambold 8334,* 5 April 1990; holo: M.

Thallus foliose, loosely adnate, to 4 cm wide. *Lobes* imbricate or not, flat or becoming distinctly revolute, irregular to sublinear-elongate, subdichotomously to subirregularly branched, 1-2 mm wide; laciniate, laciniae imbricate, sublinear, 0.4-0.8 mm wide. *Upper surface* yellow-green, dull, rugulose, ±convex, strongly white maculate to effigurate-maculate, lacking soredia and isidia. *Medulla* white. *Lower surface* smooth, ivory to brown; rhizines moderately dense, simple, 0.3-1.0 mm long, concolorous or becoming darker. *Apothecia* sessile, 0.5-1 mm wide, juvenile; disc concave, dark brown; thalline exciple smooth, involute entire. *Ascospores* immature. *Pycnidia* common, immersed. *Conidia* bifusiform, 5-6 x 1 µm.

Chemistry. Cortex K-; medulla K-, C-, KC-, P-; containing usnic acid (major), atranorin (major), dehydroconstipatic acid (major), protodehydoconstipatic acid (major), unknown fatty acids (major/minor; the latter substances are also present in *X. subdecipiens*) .

This species is characterized by the loosely adnate thallus, the narrow, irregular to sublinear lobes which become distinctly revolute, the markedly maculate upper surface, the pale lower surface and by the production of a chemosyndrome of fatty acids in the medulla. The medullary chemistry of this new species is identical to that of *X. subdecipiens* (Vain.) Hale, a species which also has a pale lower surface and lacks isidia. However, *X. subdecipiens* is distinguished by having adnate to tightly adnate thalli with broader (1-4 mm *cf.* 1-2 mm wide), flat lobes with an emaculate upper surface. At present this new species is known only from the type collection.

Xanthoparmelia magnificans Elix, sp. nov. Fig. 6

Differt a *Xanthoparmelia leonora* lobis laciniatis in centro thallo, laciinis revolutis convolutisque et pagina inferiore nigra.

Type: Republic of South Africa. Cape province: Warmbokkeveld NE of Ceres, 1 km W of Swaarmoedpas near road, 33°17'S, 19°30'E, 915 m, on flat low boulders, *D. Treibel & G. Rambold 8099,* 31 March 1990; holo: M.

Thallus foliose, loosely adnate, to 5-6 cm wide. *Lobes* imbricate at margins, sublinear to linear, irregularly to subdichotomously branched, 1.5-3 mm wide; laciniae growing out from lobules on margins of older lobes, laciniae revolute to convolute, di- to trichotomously branched, 0.3-1.0 mm wide. *Upper surface* yellow-green, convex, dull in centre but shiny at lobe apices, in part maculate, with transverse or irregular cracks, without isidia or soredia. *Medulla* white. *Lower surface* canaliculate, smooth, black within, pale brown to brown at the margins; rhizines moderately dense, simple or dichotomously branched, 0.3-0.5 mm long, concolorous or becoming darker. *Apothecia* common, short pedicellate, to 2.0 mm wide; disc concave, dark brown; thalline exciple smooth, thick, involute. *Ascospores* ellipsoid, immature, 5-6 x 3-4 μm. *Pycnidia* common, immersed. *Conidia* bifusiform, 5-7 x 1 μm.

Chemistry. Cortex K-; medulla K+ pale yellow-brown, C-, P+ orange-red; containing usnic acid (major), fumarprotocetraric acid (major), protocetraric acid (minor), virensic acid (trace).

This species is characterized by the convex lobes, the revolute to convolute laciniae growing out from lobules on margins of older lobes in the centre of the thallus, medullary fumarprotocetraric acid, the absence of isidia and the black lower surface. *Xanthoparmelia leonora* (Massal.) Hale is morphologically and chemically similar, but is distinguished by having a pale tan to brown lower surface throughout and in developing laciniae at the apices of the primary lobes. *Xanthoparmelia versicolor* Hale from Australia is sometimes morphologically very similar to *X. magnificans,* but tends to form larger thalli with more irregular lobes and contains salazinic acid in the medulla. This new species forms striking beautiful rosettes over rocks and at present is only known from the type collection.

Xanthoparmelia multiacida Elix, sp. nov. Fig. 7

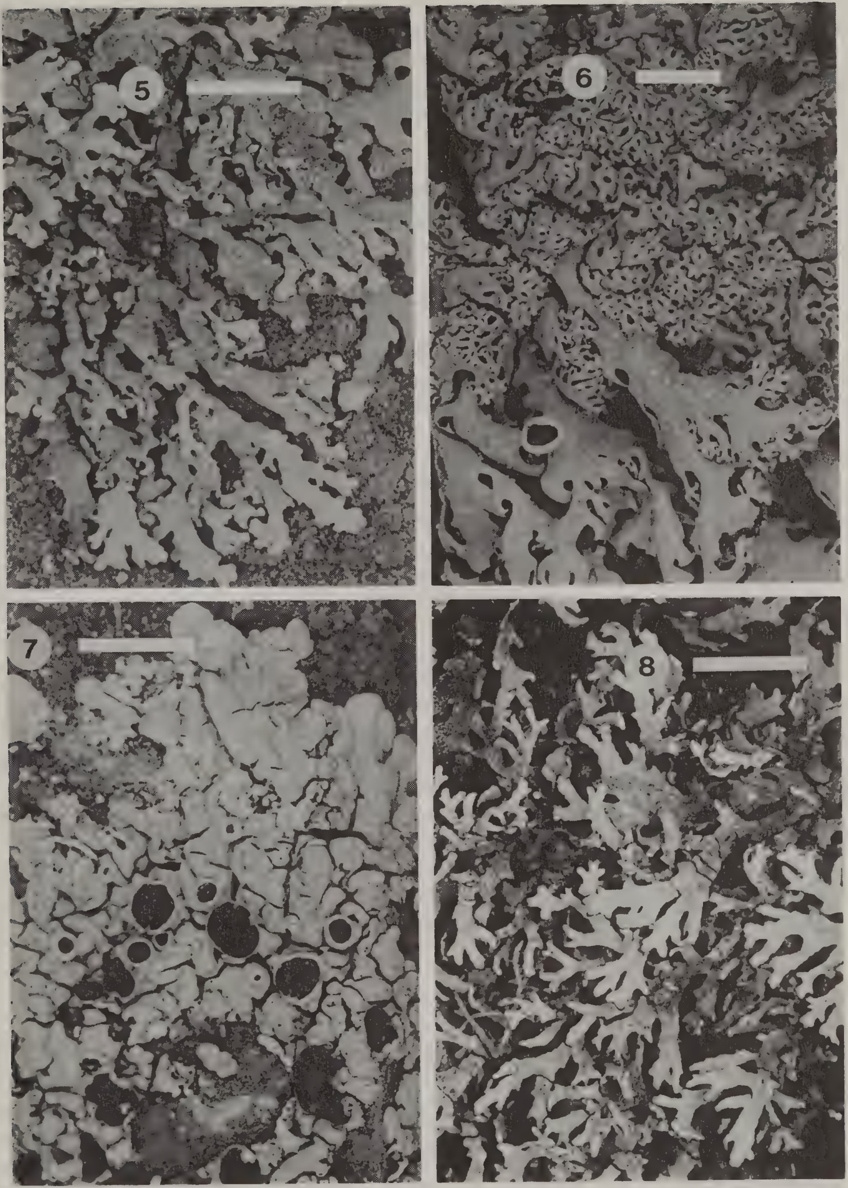
Differt a *Xanthoparmelia lineola* habitu arcte adnato et acidum echinocarpicum, acidum 4-*O*-methylhypoprotocetraricum acidum notaticum et acidum 4-*O*-methylconhypoprotocetraricum continenti.

Type: Republic of South Africa. Orange Free State: Golden Gate Highlands National Park, summit of Wodehouse Kop, 28°33'S, 28°38'E, 2434 m, on S-exposed rocks, *D. Treibel & G. Rambold 6585,* 7 March 1990; holo: M.

Thallus foliose, tightly adnate, to 4 cm wide. *Lobes* contiguous, flat sublinear to subirregular, irregularly branched, 1.5-4 mm wide. *Upper surface* pale yellow-green, dull in centre but shiny at lobe apices, smooth, ±plicate, emaculate, older lobes with transverse or irregular cracks and becoming areolate, without isidia or soredia. *Medulla* white. *Lower surface* ±dull, smooth, pale to dark brown; rhizines sparse to moderately dense, simple, 0.3-0.5 mm long, concolorous or becoming darker. *Apothecia* common, sessile, 0.7-3.5 mm wide; disc concave at first, becoming ±flat or undulate, dark brown; thalline exciple smooth, thick, involute, becoming thin and slightly lacerate. *Ascospores* ellipsoidal, 10-12 x 6-7 µm. *Pycnidia* common, immersed. *Conidia* bifusiform, 6-7 x 0.7-1 µm.

Chemistry. Cortex K-; medulla K+ pale yellow, C+ pale yellow-orange, P+ yellow; containing usnic acid, echinocarpic acid (major), 4-*O*-methylhypoprotocetraric acid (major), 4-*O*-methylconhypoprotocetraric acid (minor), notatic acid (minor), hypoprotocetraric acid (trace), conhypoprotocetraric acid (trace), conechinocarpic acid (trace), unknowns (major/minor).

This species is characterized by the tightly adnate, foliose thallus, the pale lower surface, the absence of isidia, and 4-*O*-methylhypoprotocetraric and echinocarpic acids in the medulla. *Xanthoparmelia multiacida* resembles *X. lineola* (Berry) Egan as both have adnate or tightly adnate thalli which lack isidia, have marginal lobes with rotund apices and a pale lower surface. However, these species are clearly distinguished by their medullary chemistry - *X. lineola* containg salazinic and consalazinic acids, and *X. multiacida* echinocarpic and 4-*O*-methylconhypoprotocetraric acids. The only other species of *Xanthoparmelia* to exhibit similar, but less complicated, chemistry is *Xanthoparmelia putsoa* Hale, a species which is more loosely adnate, develops narrow, sublinear-elongate laciniae (0.5-1 mm wide) in the centre of the thallus and lacks the 4-*O*-methylhypoprotocetraric/notatic acid chemosyndrome. At present this new species is only known from the type collection.



Figures 5-8. New species of *Xanthoparmelia*: 5, *X. maculodecipiens* (holotype in M); 6, *X. magnificans* (holotype in M); 7, *X. multiacida* (holotype in M); 8, *X. squamatica* (holotype in ASU). Scale bar = 5 mm.

Xanthoparmelia squamatica Elix & Nash, sp. nov. Fig. 8

Differt a *Xanthoparmelia cedrus-montana* rhizinis parce ramosis et acidum squamaticum, acidum conechinocarpicum et acidum echinocarpicum continenti.

Type: Republic of South Africa. Cape Province: Devil's Peak, portion of Table Mountain above the University of Capetown, 33°35'S, 19°09'E, 600 m, on acidic rocks, *T. H. Nash s.n.,* 22 Jan. 1986; holo: ASU; iso: CANB.

Thallus foliose, loosely adnate, to 8 cm wide. *Lobes* loosely imbricate, flat, narrow, sublinear-elongate, di- or trichotomously branched, 0.5-2.0 mm wide. *Upper surface* yellow-green, dull in centre but shiny at lobe apices, with distinct or effigurate maculae, smooth, without isidia or soredia; lobes often black-margined, particularly towards the apices. *Medulla* white. *Lower surface* rugulose or not, black, brown at the apices; rhizines sparse to moderately dense, simple or dichotomously branched, 0.5-1.0 mm long, black. *Apothecia* not seen. *Pycnidia* common, immersed. *Conidia* weakly bifusiform, 5-6 x 0.7 µm.

Chemistry. Cortex K-; medulla K+ pale yellow-brown, C-, P+ orange-red; containing usnic acid (minor), squamatic acid (major), echinocarpic acid (trace), conechinocarpic acid (trace).

This new species belongs to the *Xanthoparmelia hypoleia* (Nyl.) Hale group, which is characterized by the narrow, sublinear-elongate lobes, the black lower surface and the distinct effigurate maculae on the upper surface. Members of this group can sometimes be distinguished by thallus adnation and lobe morphology, but are most reliably separated by their chemical constituents. *Xanthoparmelia squamatica* is distinguished by the presence of medullary squamatic, echinocarpic and conechinocarpic acids, indeed, it is the only species of *Xanthoparmelia* to do so. This species is also distinguished by the presence of both simple and dichotomously branched rhizines. At present this new species is only known from the type collection.

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LITERATURE CITED

Culberson, C. F. (1972). Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *Journal of Chromatography* **72**: 113-125.

Culberson, C. F., Culberson, W. L. & Johnson, A. (1981). A standardized TLC analysis of β-orcinol depsidones. *Bryologist* **84**: 16-29.

Culberson, C. F. & Johnson, A. (1982). Substitution of methyl *tert.*-butyl ether for diethyl ether in the standardized thin-layer chromatographic method for lichen products. *Journal of Chromatography* **238**: 483-487.

Elix, J. A. (1997). New species and new combinations in the lichen family Parmeliaceae (Ascomycotina) from South Africa. *Mycotaxon* **63**: 335-343.

Elix, J. A. (1999). Further new species and new reports in the lichen family Parmeliaceae (Ascomycotina) from South Africa. *Mycotaxon* **70**: 103-110.

Elix, J. A., Becker, U. & Follmann, G. (1999). New species of *Neofuscelia* and *Xanthoparmelia* (lichenized Ascomycotina, Parmeliaceae) from Zimbabwe. *Mycotaxon* **71**: 1-12.

Elix, J. A., & Ernst-Russell, K. D. (1993). *A Catalogue of Standardized Thin Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances,* 2nd Edn. (Australian National University, Canberra).

Elix, J. A., Johnston, J. & Parker, J. L. (1988). A Computer Program for the Rapid Identification of Lichen Substances. *Mycotaxon* **31**: 89-99.

Elix, J. A., Wardlaw, J. H., Archer, A. W., Lumbsch, H. T., & Plümper, M. (1997). Four new depsidones from *Pertusaria* and *Lecanora* lichens. *Australasian Lichenology* **41**: 22-27.

Feige, G. B., Lumbsch, H. T., Huneck, S. & Elix, J. A. (1993). The identification of lichen substances by a standardized high-performance liquid chromatographic method. *Journal of Chromatography* **646**: 417-427.

Nash, T. H. III and Elix, J. A. (1987). New species and new reports in the Parmeliaceae (lichenized Ascomycotina) from South Africa and Australia. *Mycotaxon* **29**: 467-476.

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A NEW *PHYLLOPORUS* (BASIDIOMYCETES, BOLETACEAE) WITH A KEY TO SPECIES IN COLOMBIA AND COSTA RICA

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***Abstract*:** *Phylloporus aurantiacus* is newly described from oak forests of Costa Rica. The description was generated from a DELTA data set. Macro- and microscopic features are illustrated. A dichotomous key to species known from Costa Rica and Colombia is provided.

***Key Words*:** Agaricales, biogeography, Central America, Colombia, Costa Rica, macrofungi, new species, oaks, *Quercus*.

Introduction

In this paper, we continue to document the agaric diversity of Neotropical oak forests of Costa Rica and Colombia by describing *Phylloporus aurantiacus* as a new species. Previous publications of this type are cited in Halling (1999), Halling and Franco-M. (1996), and Halling and Mueller (1999). More information is on the World Wide Web at: www.nybg.org/bsci/res/hall/costaric.html.

The descriptive data generated herein are derived from a DELTA database (Dallwitz 1980, Dallwitz, *et al.* 1993 onwards). That database also contains an interactive identification and information retrieval system using the program Intkey, running under MS-Windows (Dallwitz, *et al.* 1998). Field work, identifications, and descriptions were undertaken by the first two authors; refinements of the DELTA application(s) are the work of the third author. Descriptions, illustrations, references, and commentary that discusses distribution, related or extralimital taxa, and diagnostic features of all known Neotropical species of *Phylloporus* are on the World Wide Web at: http://www.nybg.org/bsci/res/hall/deltaindex.html.

Materials and Methods

Color designations (e.g., 4A3) in the following description are from Kornerup and Wanscher (1983). Line drawings were made with the aid of a drawing tube. All measurements of microscopic structures were made in 3% KOH. Letter abbreviations describing spore sizes are: n = number of spores measured, $\bar{x}$ = mean length × mean width, Q = mean length/width ratio. Herbarium acronyms are from Holmgren *et al.* (1990). A color image of basidiomata can be viewed from a list at our web site: www.nybg.org/bsci/res/hall/phylred.html.

Taxonomy

Key to *Phylloporus* in Costa Rica and Colombia

1. Spores amyloid . . . . *P. guanacastensis* Gómez (1996)

1. Spores inamyloid or dextrinoid 2

  2. Clamp connections present at hyphal septa; NH_4OH not bluing pileus surface . . . . *P. fibulatus* Singer, *et al.* (1990) [Colombia, but to be expected in Costa Rica]

  2. Clamp connections absent or only very exceptional; NH_4OH typically reacting bluish green on pileus surface (if negative then basidiomata bright orange and spores ovoid) 3

    3. Associated with alder (*Alnus acuminata*) . . . .*P. caballeroi* Singer (1973)

    3. Associated with oak (*Quercus* spp.) 4

      4. Basidiomata orange-red; spores ovoid . . . .***P. aurantiacus*** Halling & Mueller

      4. Basidiomata colored otherwise; spores fusoid to subcylindric 5

        5. Basal mycelium of stipe white when fresh and when dried; pileipellis lacking chains of sphaerocyst-like isodiametric elements 6

          6. Hymenial cystidia thin-walled and lacking incrustions; lamellae frequently cyanescent 7

            7. Pileus tan to brown . . . .*P. bellus* (Massee) Corner (1970)

            7. Pileus pinkish purple . . . .*P. purpurellus* Singer (1973) [Colombia, but to be expected in Costa Rica]

          6. Many cystidia thick-walled and incrusted; lamellae rarely cyanescent . . . . *P. centroamericanus* Singer & Gómez (1984)

        5. Basal mycelium of stipe yellow when fresh and when dried; pileipellis with chains of isodiametric elements . . . . *P. phaeoxanthus* Singer & Gómez (1984)

          8. Cystidia not incrusted . . . . .var. *simplex*

          8. Cystidia distinctly incrusted with a resinous material . . . . var. *phaeoxanthus*

Phylloporus aurantiacus Halling & Mueller, sp. nov. Figs. 1–4

Basidiomata aurantiaca, lamellis et stipite cyaneotinctis, contexto flavo immutabili, mycelio basali flavo, basidiospora ovoideis inferme dextrinoideis 5.6–7.7 × 3.5–5 µm, fibulis nullis.

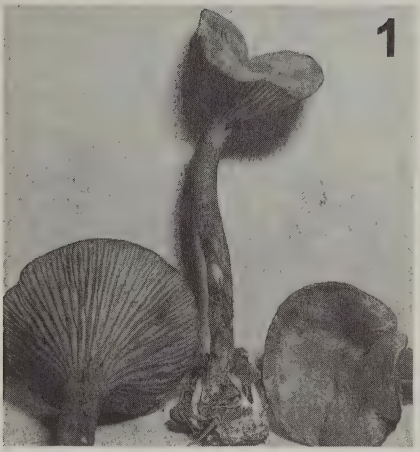
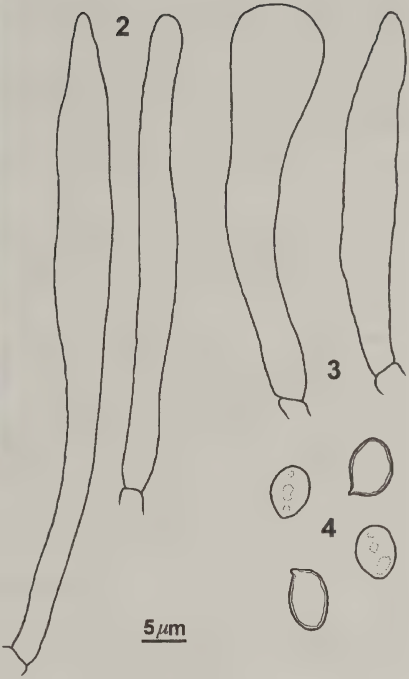


Fig. 1. Habit of *Phylloporus aurantiacus* (holotype). × 2.



Figs. 2–4. Microscopic features of *Phylloporus aurantiacus*. 2. Hymenial cystidia. 3. Caulocystidia. 4. Basidiospores.

Pileus 1–3 cm broad, at first plane, with age depressed, dry, at first orange, then orange to yellow orange (6-7B-C8-7, 4A6); disc and margin even; matted tomentose to tomentose, becoming matted subtomentose; maculose color spots absent or present (sometimes), yellow; with NH_4 no reaction (same reaction in pileus flesh). *Flesh* 2–5 mm thick, yellow, staining absent; odor mild; taste mild. *Hymenophore* lamellate, decurrent. *Lamellae* 1–3 mm wide, close, not anastamosing, rarely somewhat intervenose, when young orange to orange brown (7C8), with age orange to orange brown, staining green; edges even. *Stipe* 3–5 cm long, 4–5 mm wide, equal, strict, not radicating, dry; when young floccose to fibrillose, red to orange (with yellow undertones), with age floccose to fibrillose, red to orange (with yellow undertones), greening when bruised; base yellow, staining not present. *Stipe interior* solid; flesh above when young yellow, with age yellow, staining not present; flesh at base when young yellow, with age yellow, staining not present. *Basal mycelium* bright yellow.

Basidiospores 5.6–7.7 µm long, 3.5–5 µm wide, ($n = 10$, $\bar{x} = 6.8 \times 3.5$ µm, $Q = 1.6$), smooth, ovoid to subellipsoid, weakly dextrinoid, with KOH straw yellow. *Basidia* 35–42 µm long, 8–10.5 µm wide, cylindric to clavate, hyaline, 4-sterigmate. *Hymenial cystidia* 60–90 µm long, 7–10 µm wide, more common on sides of lamellae, thin-walled, hyaline, subfusoid to subcylindrical, gelatinization absent, encrusting pigment absent. *Hymenophoral trama* hyphae bilateral (phylloporoid), 2–6 µm wide, yellow brown in the central stratum, inamyloid. *Pileipellis hyphae* a trichodermium (tangled), in KOH orange to yellow ochraceous, inamyloid; elements 3.5–7 µm wide, cylindric to elongated, smooth, thin-walled, granular content absent, not gelatinized. *Pileus trama* interwoven, hyaline, inamyloid, with elements 3.5–10 µm wide, smooth (but dissolving a bright yellow pigment in KOH), thin-walled. *Stipitipellis* hyphae vertically oriented, parallel, giving rise to clusters of *caulocystidia*, 35–90 µm long, 7–10 µm wide, clavate to subfusoid, hyaline to orange, with incrusting pigment absent. *Stipe trama* hyphae parallel, cylindric, hyaline, inamyloid. *Clamp connections* absent.

Habit, habitat, and distribution: gregarious, on soil in mixed woods with *Quercus* spp.

Material examined: COSTA RICA. Cartago: near town of Palo Verde, ±4.5 km E of km 31 of Interamerican Highway, 9°46'34"N, 83°56'42"W, 1600 m, 11 June 1994, *Halling 7271* (HOLOTYPE: USJ, ISOTYPE: NY).

Commentary: This species seems closest to *P. coccineus* described by Corner (1970) from Singapore. The yellow basal mycelium as well as the overall colors are similar. The spores of both taxa are ovoid, an uncommon shape in the genus, and both lack clamp connections. However, Corner's fungus has yellow flesh that is cyanescent, and the spores are larger (7.5–9 × 6.5–7.5 µm). The Costa Rican entity has yellow flesh but doesn't change to blue green when exposed. There is a water soluble pigment which dissolves and turns microscopic mounts yellow. So far *P. aurantiacus* is known only from one site in Cartago Province in the northern Talamancas.

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Literature Cited

Corner, E. J. H. 1970. *Phylloporus* Quél. and *Paxillus* Fr. in Malaya and Borneo. Nova Hedwiga 20: 793–822.

Dallwitz, M. J. 1980. A general system for coding taxonomic descriptions. Taxon 29: 41–46.

—, T. A. Paine, and E. J. Zurcher. 1993 onwards. 'User's Guide to the DELTA System: a General System for Processing Taxonomic Descriptions.' 4th edition. http://biodiversity.uno.edu/delta/

—, —,and —. 1998. Interactive keys. In 'Information Technology, Plant Pathology and Biodiversity', pp. 201–212. (Eds P. Bridge, P. Jeffries, D. R. Morse, and P. R. Scott.) (CAB International: Wallingford.)

Gómez, L. D. 1996 (1997). Basidiomicetes de Costa Rica: *Xerocomus, Chalciporus, Pulveroboletus, Boletellus, Xanthoconium* (Agaricales: Boletaaceae). Rev. Biol. Trop. 44(suppl. 4): 59-89.

Halling, R. E. 1999. New Leccinums from Costa Rica. Kew Bull. 54: (in press).

—, and Franco-M. 1996. Agaricales from Costa Rica: New taxa with ornamented spores. Mycologia 88: 666–670.

—, and G. M. Mueller. 1999. New boletes from Costa Rica. Mycologia 91: (in press).

Holmgren, P. K., N. H. Holmgren, and L. C. Barnett. 1990. Index Herbariorum Part I: The herbaria of the World. Reg. Veg. 120: 1-693.

Kornerup, A. and J. H. Wanscher. 1983. Methuen Handbook of Colour. Ed. 3. Eyre Methuen, Ltd., London, U.K. 252 pp.

Singer, R. 1973. Diagnoses fungorum novorum agaricalium. Beih. Sydowia, 7: 1-106.

—, and L. D. Gómez. 1984. The Basidiomycetes of Costa Rica. III. The genus *Phylloporus* (Boletaceae). Brenesia 22: 163-181.

—, C. L. Ovrebo, and R. E. Halling. 1990. New species of *Phylloporus* and *Tricholomopsis* from Colombia, with notes on *Phylloporus boletinoides*. Mycologia 82: 452- 459.

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ACANTHOTHECIS AND OTHER GRAPHIDIOID LICHENS WITH WARTY PERIPHYSOIDS OR PARAPHYSIS-TIPS *

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ABSTRACT: The occurrence of spiny paraphysis-tips and/or periphysoids in lichenized ascomycetes has been till now only reported from 3 species of *Acanthothecis* and 1 species of *Chroodiscus*. We add 29 more species, mostly members of the lichen family Graphidaceae. Descriptions of all hitherto known species with this character as well as generic concepts for the genera *Fissurina* and *Acanthothecis* (Graphidaceae) are provided.

In *Acanthothecis* three new species are described: *Acanthothecis gracilis*, *A. mirabilis* and *A. obscura*. Thirteen species formerly described in the genera *Graphis* or *Graphina* are combined to *Acanthothecis*: *Acanthothecis abaphoides* (= *Graphina abaphoides*), *A. albescens* (= *Graphis albescens*), *A. consocians* (= *Graphis consocians*), *A. corcovadensis* (= *Graphina corcovadensis*), *A. hololeucoides* (= *Graphina hololeucoides*), *A. incondita* (= *Graphina incondita*), *A. intertexta* (= *Graphis intertexta*), *A. leucolyta* (= *Graphina leucolyta*), *A. leucoxantha* (= *Graphis leucoxantha*), *A. sanguinoloba* (= *Graphis sanguinoloba*) *A. silicicola* (= *Graphis silicicola*), *A. tetraphora* (= *Graphina tetraphora*). *Acanthothecium clavuliferum* is formally combined to *Acanthothecis*. Three species that are well distinguishable from the others are mentioned, but are not formally described as new for science as the material is too scarce: *A. bicellulata* ad int. *A. farinosa* ad int. and *A. subabaphoides* ad int.

The genus *Fissurina* Fée based on *Fissurina dumastii* (Lectotype selected here) is reintroduced.

*** We dedicate this paper to Prof. Dr. Andreas Bresinsky, University of Regensburg, on occation of his 65th birthday.**

Two species in the genus *Fissurina* – *F. dumastii* and *F. instabilis* – show spiny periphysoids and paraphysis-tips and are treated here.

Within the family Graphidaceae, seven further species with spiny periphysoids are recognized: *Graphina amicta*, *Graphina marcescens*, *Graphis candidata*, *Graphis chionophora*, *Graphis* cf. *sauroidea*, *Phaeographina crassa*, *Graphina subalbotecta* ad int. They share several characters and seem to form a natural group but so far no systematic conclusions are drawn from these observations.

Four species with spiny paraphysis-tips and periphysoids do not belong to the family Graphidaceae: *Chroodiscus brasilianus* is a member of the closely related family Thelotremataceae; the other three species are of uncertain systematic position and could not be identified with the available keys or descriptions. We list them with their herbarium accession numbers.

The following species are reduced into synonymy: *Graphina atractospora* (= *Acanthothecis abaphoides*), *Acanthothecis pachygraphoides* (= *A. hololeucoides*), *Acanthothecis caesiocarnea* (= *A. hololeucoides*), *Graphis singaporina* (= *Graphis candidata*), *Thelotrema carneoradians* (= *Chroodiscus brasilianus*).

All species are provided with detailed descriptions; drawings and photographs illustrate the most important characters. The species and their chemical compounds are listed in a table.

Keys for all hitherto known species with spiny periphysoids and paraphysis-tips, as well as for all known *Acanthothecis*-species, are included.

1. Introduction

VAINIO (1890) described the lichen genus *Acanthothecium* and stated in the protologue: "Paraphyses numerosae, neque ramosae, nec connexae, apice clavatae, clava creberrime minutissimeque verruculosa subspinulosave". This was the first time that warty paraphysis-tips had been reported from lichens. He described two species with muriform ascospores, *Acanthothecium pachygraphoides* and *A. caesiocarneum*, placing them in the section *Acanthographina*, and one species with transversely septate spores, *A. clavuliferum*, placing it in the section *Acanthographis*. CLEMENTS (1909) split the genus and used the name *Acanthothecis* for the species with muriform ascospores and *Psorographis* for the species with transversely septate ascospores. CLEMENTS & SHEAR (1931) selected *A. pachygraphoides* as type species for *Acanthothecis* and *A. clavuliferum* for *Psorographis*. The name *Acanthothecium* Vain. had to be rejected as SPEGAZZINI (1889) had already described a fungal genus (Discellaceae) with the same name.

Clements' paper had obviously been overlooked by ZAHLBRUCKNER (1923), who introduced the new name *Acanthotheciopsis* for the same reason, and by WATSON (1929), who described the genera *Acanthographina* and *Acanthographis*. Watson did not refer to Vainio's sections but used the same character (spore septation) to distinguish the genera. All three genera are based on either *Acanthothecium pachygraphoides* (*Acanthographina, Acanthotheciopsis*) or *Acanthothecium clavulifera* (*Acanthographis*). In the latest "Outline of the Ascomycetes - 1998" (ERIKSSON & HAWKSWORTH 1998) *Acanthothecis* is accepted by the authors, while the other genera, also those based on *A. clavulifera*, are mentioned as synonyms.

The occurrence of verrucose-spiny periphysoids and paraphysis-tips are thought to be restricted to the genus *Acanthothecis* and therefore this character was used to separate *Acanthothecis* from the other genera within the Graphidaceae. SIPMAN (1992) described a new *Thelotrema* species (*Thelotrema carneoradians* Sipm. = *Thelotrema brasilianum* Hale) from Venezuela, showing spiny periphysoids and paraphysis-tips with fine SEM photos. This was the first report of this character from a species (genus) not in *Acanthothecis* nor in the Graphidaceae.

In the course of a study with the aim to get a more natural division of the family Graphidaceae ca. 500 samples of tropical graphidioid lichens (Africa poorly represented), mainly from the herbarium K. Kalb, but also from various other herbaria mentioned below, have been examined microscopically. More than 80 of these have been observed to have spiny paraphysis-tips and/or periphysoids. These are presented here.

2. Material and methods

2.1. Material and determination:

More than 80 samples from Münchner Staatssammlung (M) and the private herbarium of K. KALB mostly from the Neotropics [Brazil, Paraguay, Costa Rica, Guatemala, Venezuela, Guyana, Mexico, U.S.A. (Louisiana, Florida)] but also from other tropical regions (Papua New Guinea, Malaysia, Réunion, Australia) have been analysed. Determinations with the keys for Graphidaceae from REDINGER (1933a, b, 1935 - Philippines, Brazil), WIRTH & HALE (1963, 1978 - Mexico, Dominica), HARRIS (1990, 1995 - Florida) and for Thelotremataceae (HALE 1974, 1978, 1981) were carried out. In the herbaria of Munich (M), Helsinki (H-ACH and H-NYL) and Turku (TUR-V) we searched for type material. In addition the type specimens of the species whose descriptions could match our samples were examined; mainly from the herbaria Geneva (G), and Stockholm (S). Altogether ca. 200 types have been checked.

Most of the samples belong to the family Graphidaceae. As ca. 1000 species (HAWKSWORTH et al. 1995) are thought to belong to this family it was not possible to check all names, descriptions and types.

In cases where no type was available for examination the abbreviation "cf." is added to the specific name. All species mentioned without this annotation have been compared with the type.

The specimens examined are listed following the order and the geographical divisions proposed by HOLLIS & BRUMMIT (1992).

2.2. Thin layer chromatography (TLC):

The samples were analysed using the standardized method by CULBERSON & KRISTINSSON (1970), CULBERSON (1972) and CULBERSON & JOHNSON (1982).

2.3. Scanning electron microscopy (SEM):

The examinations have been carried out with a Digital Scanning Microscope DSM 950 (Zeiss). The upper part of the hymenium (paraphysis-tips) or the margins of the hysterothecium (periphysoids) were dissected and fixed to metal stubs. The samples were coated (Polaron SEM SC515 Coating system) with a gold/palladium alloy up to 1.4 nm. We used an Ilford FP4-film for the photographs.

2.4. Light microscopy

The anatomy of thallus and apothecia were usually examined from hand-cut sections in water with and without pretreatment in Lactophenol-cottonblue (Merck 13741). In some cases microtome-sections were made in order to study the excipulum structure. The amyloidity of the ascospores, the hymenium and the exciple were checked routinely with Lugol's solution (Merck 9261). By adding K (10% hydrous solution of KOH) the spiny structure of the paraphyses and periphysoids appears more distinct. All measurements were carried out with an enlargement of 1000fold and anisol as immersion medium.

3. Results

3.1. General part

We have found 28 additional species to those already described with the character ”warty paraphysis-tips and/or periphysoids” and at least some of them differ considerably from the so far known *Acanthothecis*-species and belong to other genera. So warty paraphysis-tips and periphysoids are obviously not restricted to the genus *Acanthothecis* but are analogies even in different families. Thus it became necessary to elaborate a new generic concept for *Acanthothecis* that included more morphological and anatomical data. Referring to this new circumscription, as presented below, 18 species belong to *Acanthothecis*.

But to which genera (families) the other species with warty periphysoids and paraphyses belong is not yet fully understood.

The species described by SIPMAN (1992) as *Thelotrema carneoradians* (= *Thelotrema brasilianum*) has chroodiscoid ascocarps and ascospore type (i. e. thin-walled and ± halonate) and therefore should be placed in the genus *Chroodiscus*, which is located in Thelotremataceae.

Three species have an ascus structure different from Graphidaceae and so do not belong to the family (fig. 1 - 4). Their systematic position is unclear.

The rest of the species clearly belongs to the family Graphidaceae and they can be divided in two groups:

- Species with distinctly carbonized, cupular (in cross section!) excipulum and with only warty periphysoids, the paraphysis-tips being smooth (fig. 5).
- Species with fissurine ascocarps, an uncarbonized excipulum, and both, warty periphysoids and paraphysis-tips (fig. 6).

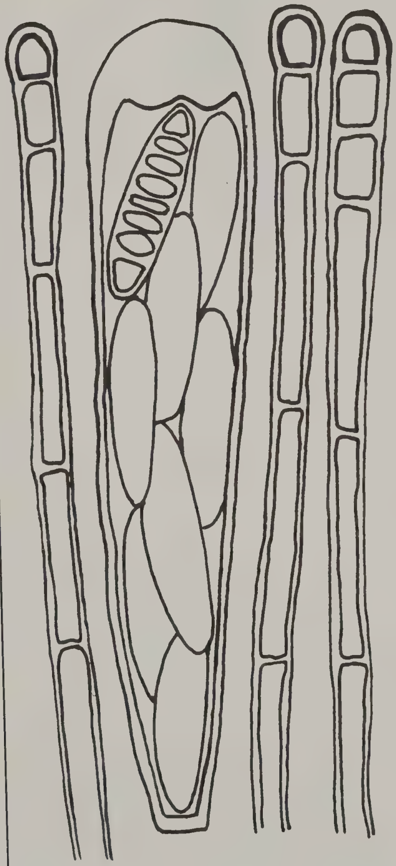


Fig. 1

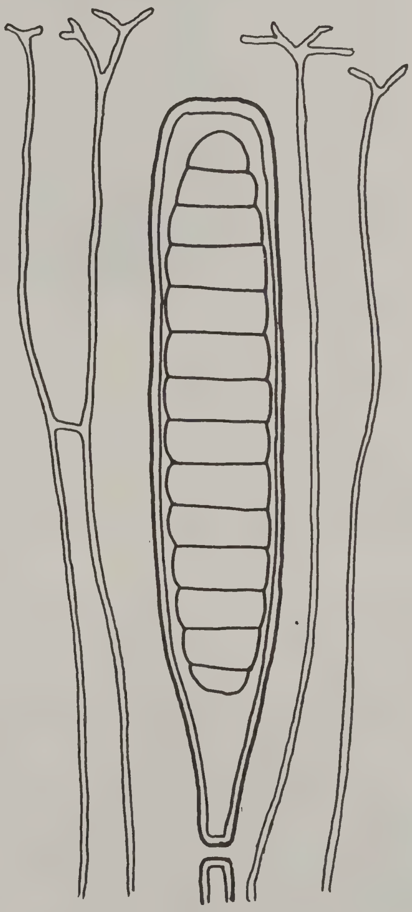


Fig. 2

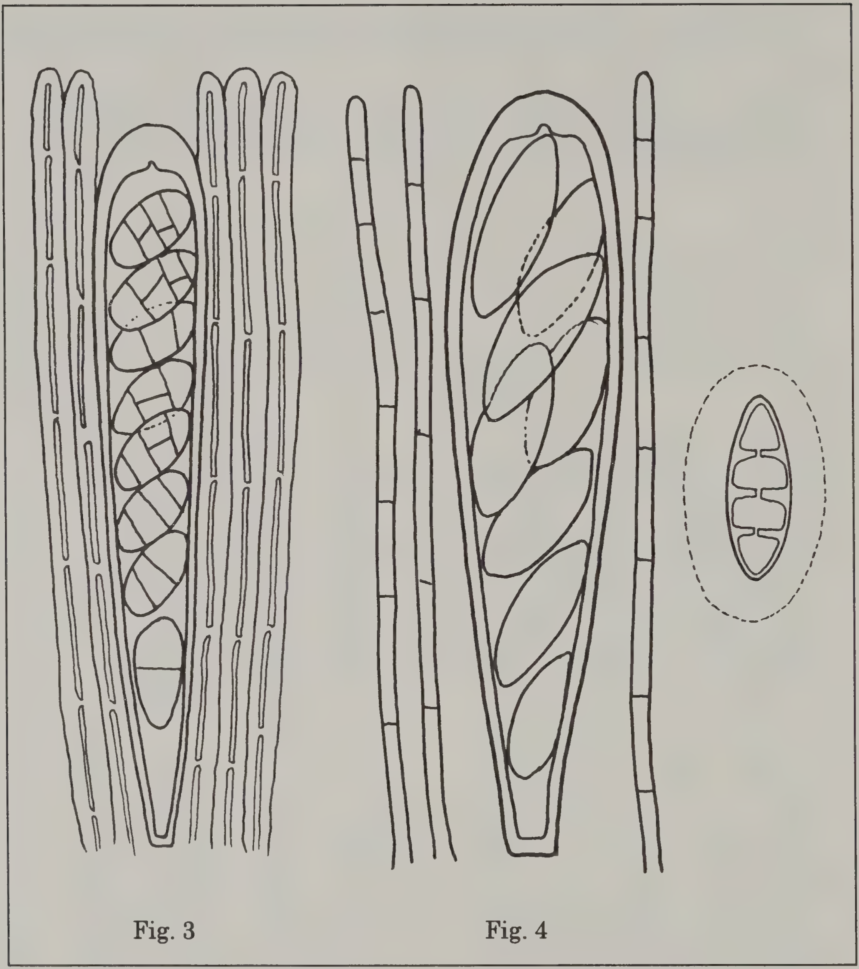


Fig. 3 Fig. 4

Fig. 1 - 4: Asci and spores of *Graphis scripta* (fig. 1), KALB 31325 (fig. 2), KALB 29942 (fig. 3) and KALB 28829 with young, halonate ascospore (fig. 4)

The generic concept in the Graphidaceae is still based on the system of MÜLLER ARG. (1880, 1882) using spore septation and spore colour as the most important characters (spore genera). It had to be decided whether we should follow this system using the spore genera *Graphis*, *Phaeographis*, *Graphina*, *Phaeographina* or whether a new, more natural concept should be elaborated. In the course of a study with this objective, considering all genera and their synonyms (some 50 names) so far described, we here propose to reintroduce the old generic name *Fissurina* Fée for the fissurine species as they are already well studied and seem to form a natural group. The species with a carbonized excipulum will remain for the time being in one of the "spore genera" as we only have preliminary results concerning this group. We hope to deal with this group in a forthcoming paper.

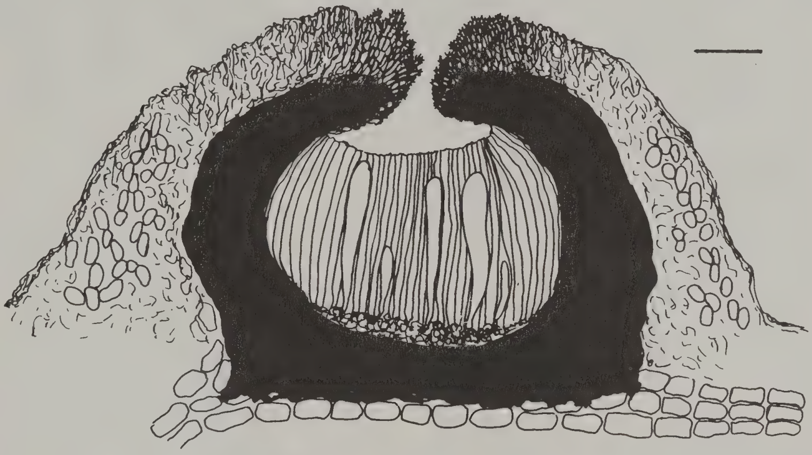


Fig. 5

Fig. 5: *Graphis chionophora* [KALB 28845a]; bar = 40 µm

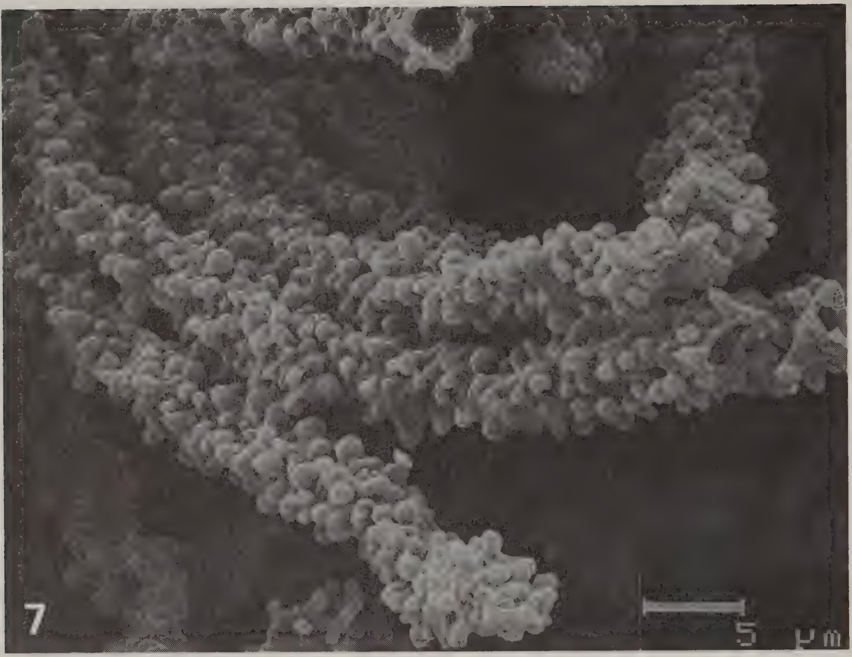
3.2. Morphology and anatomy - definition and explanation of terms used here

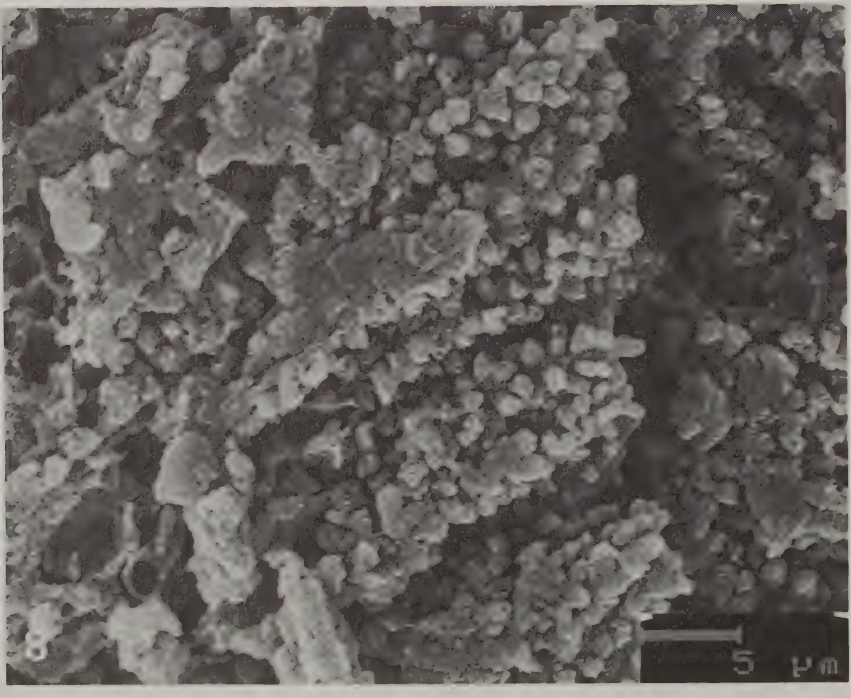
(1) Periphysoids:

HENSSEN & JAHNS (1974) define them as "short hyphae that develop laterally of the hymenium from the excipulum of an apothecium and resemble periphyses." In the explanations of *Acanthotheciopsis* (= *Acanthothecis*) they use this term in quotation marks because the "periphysoids" develop from the thalline margin of the ascocarp (and not from the excipulum).

POELT (1969) describes them as follows: Hyphae comparable to periphyses in the ostiola of apothecia that keep closed for a longer time.

We use this term in a wide sense for hyaline ± separate hyphae that develop from the lateral excipulum or the margins of the ascocarp and resemble periphyses. In the species presented below they have a warty surface. They vary considerably in length, reaching sizes up to 50 µm, e. g. in *A. corcovadensis* (fig. 7) and mostly cover the margins near the opening of the apothecium. They are responsible for the whitish pruinose appearance of most ascocarps.


7
5 μm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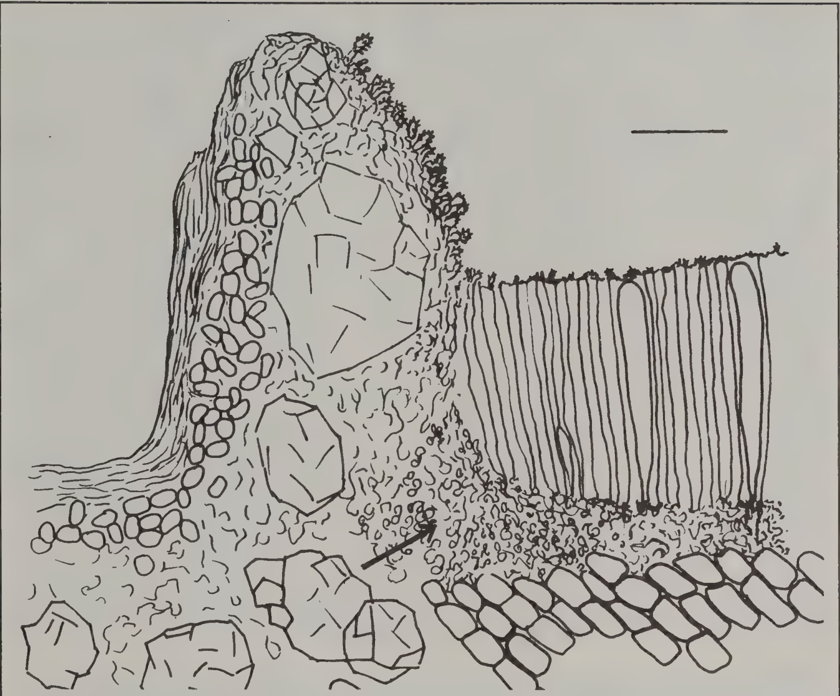
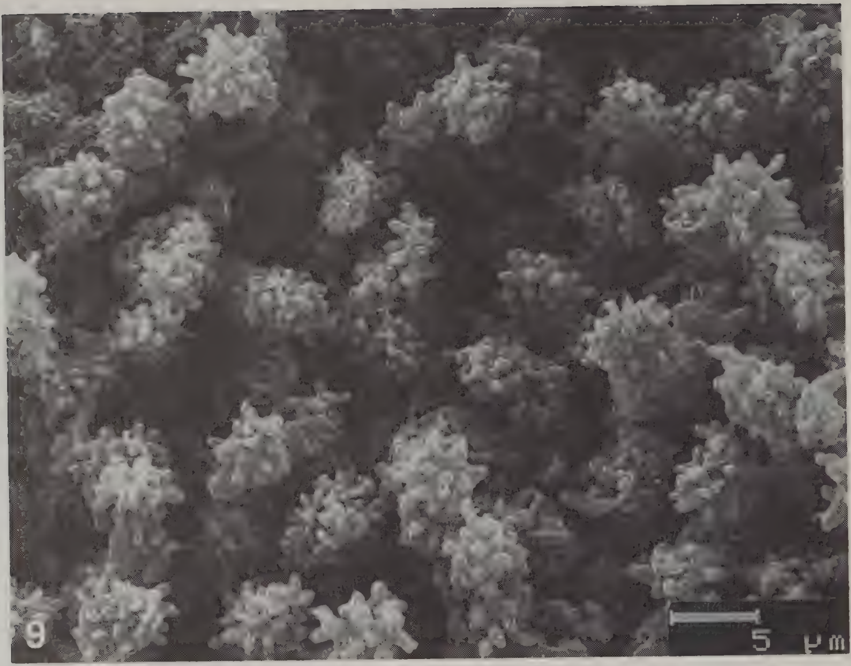


Fig. 6

Fig. 6: *Fissurina dumastii* [KALB 31303]; bar = 40 µm

So far it is badly understood and difficult to examine how and when the periphysoids are generated in the course of the ascocarp development. We have only examined it in more detail in *A. silicicola,* therefore it is not completely sure that the ontogeny is exactly the same in other *Acanthothecis* species: They are generated after the opening of the ascocarp out of the former "covering layer" of the young ascocarp that later forms the margins. They may resemble *Thelotrema*-periphysoids, but they are not part of an inner excipulum as in the case of *Thelotrema*. In other species of *Acanthothecis* with less prominent margins (e. g. *A. albescens*) it is not obvious whether they develop from excipular hyphae or are also part of the layer formerly covering the ascocarps.

Fig. 7 - 8: Especially long periphysoids of *Acanthothecis corcovadensis* [KALB 31281] (fig. 7) and periphysoids of *Graphina chionophora* [KALB 28846], growing out of carbonized excipular hyphae (fig. 8).



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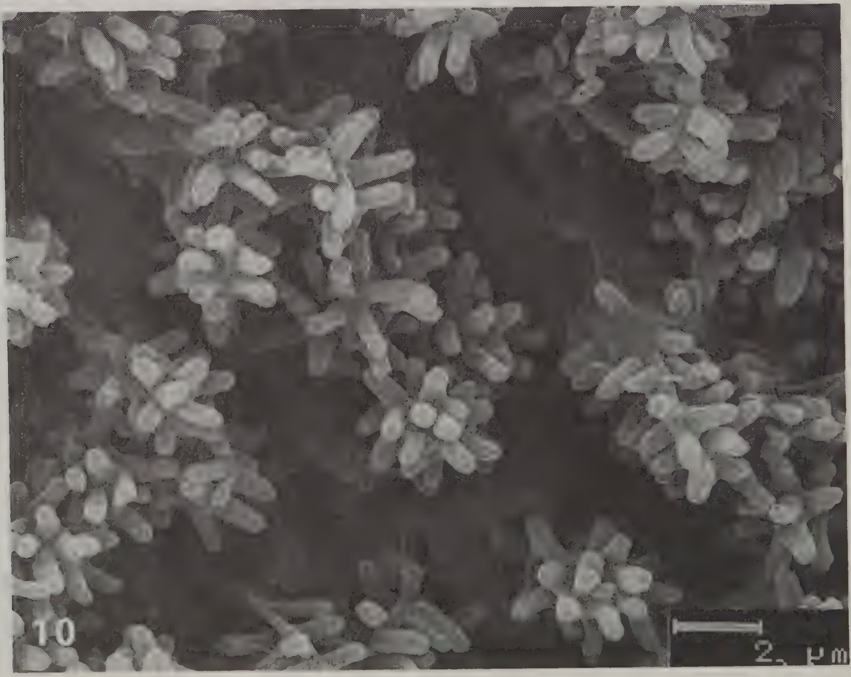


10

The periphysoids of *Acanthothecis* are probably not homologous to those (without spines) in *Thelotrema* and those in the "carbonized group".

In species with pear-like or round (in cross section!), carbonized excipula ("carbonized group") the periphysoids grow out of carbonized excipular hyphae and loom into the slit and cover the ends of the margins (fig. 5 & 8).

(2) Warts:

It was not possible to determine whether the warts or spines are a formation of the hyphal cell wall or an evagination of the plasmalemma. Nothing is known about their function. It has been observed that those parts of the ascocarp with warty periphysoids or paraphyses are difficult to moisten as the surface is not wettable. In most species the warts reach a length of ca. 1 µm and are arranged more or less regularly covering the tips of paraphyses and mostly the whole periphysoids (fig. 9 and 10).

In some species the warts are difficult to detect. Often the periphysoids are short and not all of them have warty tips, in addition the warts may be irregularly formed and short (e. g. in *Graphis* cf. *sauroidea*). Long periphysoids can break off easily and especially in old samples or old ascocarps the "pruinose" layer of periphysoids may have been rubbed away.

(3) Excipulum:

HENSSEN & JAHNS (1974) define it as follows: Excipulum proprium: Protective layer around the hymenium of an apothecium that develops from generative hyphae (annular = like a ring; cupular = like a cup). Poelt uses the term "Gehäuse" (= container) in a broader sense (POELT 1969): Sterile wrapping of the hymenia differing distinctly from the thallus regardless how it has developed and differentiated.

We here consider as excipulum those hyphae surrounding the hymenium that do not belong to the thallus, i. e. excipulum proprium. The upper parts of the excipulum that tower above the hymenium are sometimes named "margins" as they form the "visible" outer part of the excipulum.

Often substratum and excipulum are difficult to distinguish. Especially in those species with a carbonized excipulum, parts of the substratum are carbonized too, and bark cells are integrated in the excipulum. In some species the excipulum is only poorly developed and uncarbonized. Often the hymenium is concealed in the thallus and surrounded by calcium oxalate crystals (*A. albescens*). Whether all members of the order Ostropales have a cupular excipulum (HENSSEN & JAHNS (1974) is doubtful in species where the basal part of the excipulum is only poorly developed or completely lacking.

The carbonization of excipular hyphae is a specific character. But often the degree of carbonization can vary considerably, above all at the basal parts of the excipulum. It is difficult to decide whether brownish parts of the excipulum are a first step in the development towards carbonization or if it is a constant character.

Fig. 9 - 10: Warts on the periphysoids of *Acanthothecis consocians* [KALB 29316] (fig. 9) and *Graphina subalbotecta* [KALB 28860] (fig. 10).

3.3. Generic delimitation

Typical species of the genera treated here are easy to distinguish - *Fissurina* (lectotypified with *Fissurina dumastii*) is characterized by the crack-like ascocarps and other authors (NYLANDER 1888a, b, WIRTH & HALE 1978) recognize a group of "fissurine" species in the genera *Graphina* and *Graphis* (e. g. *Graphina incrustans*, *Graphis triticea*). Most of these species show the characters listed in the generic description of *Fissurina*, such as uncarbonized excipulum, thallus with well-developed cortex, ovoid, hyaline ascospores, mostly with a thick halo etc., and they should belong to *Fissurina*. Warty paraphyses and periphysoids were observed only in two species (*F. dumastii* and *F. instabilis*) and are therefore not characteristic for the whole genus.

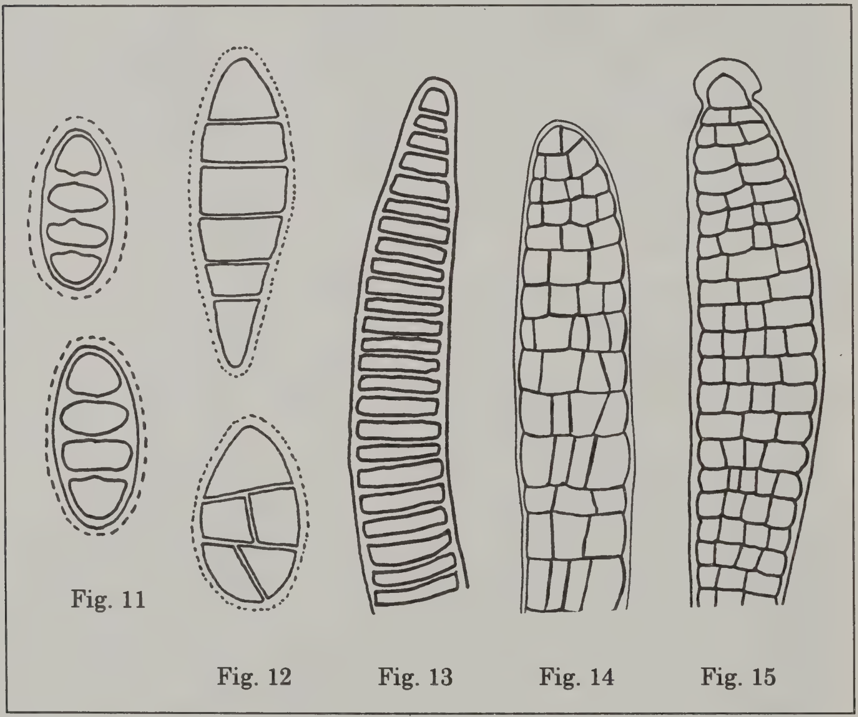


Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 15

Fig. 11 - 15: Ascospores; *Fissurina dumastii* [KALB 31303] (fig. 11), *Chroodiscus brasilianus* [KALB 21318] (fig. 12), *Acanthothecis clavulifera* [KALB 22721] (fig. 13), *A. hololeucoides* [TUR-VAIN. 27023] (fig. 14), *A. abaphoides* [KALB 31324] (fig. 15); bar = 10 µm

Species	**Genus or Group**	**Family or systematic position**	**Characters of the treated species**
A. abaphoides *A. albescens* *A. clavulifera* *A. consocians* *A. corcovadensis* *A. gracilis* *A. hololeucoides* *A. incondita* *A. intertexta* *A. leucolyta* *A. leucoxantha* *A. mirabilis* *A. obscura* *A. silicicola* *A. sanguinoloba* *A. tetraphora* *A. bicellulata* *A. farinosa* *A. subabaphoides*	*Acanthothecis* Clem.	Graphidaceae	ascocarps with distinct margins or ± fissurine; ascospores oblong; new hymenia can develop below the old one.
F. dumastii *F. instabilis*	*Fissurina* Fée	Graphidaceae	ascocarps fissurine; ascospores ovoid, with halo
Graphina amicta *Graphina marcescens* *Graphis chionophora* *Graphis* cf. *sauroidea* *Graphis candidata* *Phaeographina crassa* *Graphina subalbotecta*	”carbonized group“	Graphidaceae	carbonized, closed excipulum; only periphysoids warty
KALB 31325	?	unclear	1-spored ascus; ascospore with transverse septa only; uncarbonized excipulum

Table 1: Outline of species with warty periphysoids and/or paraphysis-tips and their systematic position. Names indicated ”cf.” = no type was available for comparison.

KALB 29942	?	unclear	periphysoids with distinct spines resembling short branches; excipulum carbonized
KALB 28829	?	unclear	excipulum carbonized; ascospores (young) halonate

Table 1

Similar to *Fissurina* in thallus structure and ascocarp development seems to be *Chroodiscus brasilianus*. In spite of these similarities it can be distinguished from *Fissurina* species as the ascospores are thin-walled with cylindrical locules (fig. 12) whereas in *Fissurina* the ascospores are thick-walled (endospore well developed) and the locules are rounded or lens shaped (fig. 11).

The chroodiscoid species in Thelotremataceae and the species of *Fissurina* in Graphidaceae are very closely related and seem to connect the families. The current family concept considering ascocarp shape (round or lirelliform) as the main difference is quite unsatisfactory. It will be necessary to examine also with molecular methods more genera and species in Thelotremataceae and Graphidaceae to improve this concept.

The differentiation of *Fissurina* against *Acanthothecis* may be problematic in *Acanthothecis* species with fissurine ascocarps without prominent margins.

In a typical *Acanthothecis* species, such as the lectotype species *Acanthothecis pachygraphoides* (Clements & Shear 1931) or *A. hololeucoides*, the margins are very prominent, bulging and often crenate. New hymenia can develop below the old ascocarp and push it aside (fig. 22). The margins therefore consist of the old ascocarps and increase with age. This phenomenon is reported from other Graphidaceae too, e. g. *Graphis elegans*. But it is no generic character for *Acanthothecis* as we could not find it in all species. Less "typical" species which have fissurine ascocarps can be distinguished from *Fissurina* by the following characters: The thallus usually does not show a distinct cortex-layer and the margins are often without algae. The ascospores are oblong and usually without a halo.

The reaction with I often shows blue staining of the parathecium in some species of *Acanthothecis* (e. g. *A. leucolyta*, *A. incondita*) whereas in *Fissurina* only the excipulum corner turns blue-violet.

In some *Acanthothecis* species (*A. obscura*, *A. tetraphora*, *A. bicellulata*) brownish or carbonized hyphae form part of the excipulum or the margins. We do not consider this kind of carbonization to be important in respect of the generic delimitation as transitions from heavily carbonized to less carbonized forms were observed.

Even distinctly carbonized species such as *A. obscura* can be differentiated from the "carbonized group" by excipular characters: The disc is more or less exposed, and the excipulum is never closed below the hymenium. The ascocarp is not raised from the thallus and no slit-like opening is formed by the margins. Additionally all *Acanthothecis* species with carbonized or brownish parts have warty paraphysis-tips and periphysoids whereas in the "carbonized group" only the periphysoids are warty.

An investigation of ascocarp development would probably reveal additional differences between the genera, but only few samples can be used for this kind of examination. In addition such studies are technically difficult and time-consuming. However, our studies with a sample of *Acanthothecis silicicola* showed well the hemiangiocarp development of the lirellae, which had been recorded by HENSSEN & JAHNS (1974) for the genus *Acanthothecis*, as well as the capability of building new ascocarps inside the old ones.

3.4. Species delimitation

The following characters are considered to be important for the delimitation of species:

(1) Ascospores:

The spore size and septation was found to be a reliable character. *Acanthothecis clavulifera* and *A. hololeucoides* can be separated by the presence/absence of longitudinal septa (fig. 13 and fig. 14); *A. albescens* and *A. leucoxantha* differ in spore size and number of locules. Where spore sizes overlap (*A. gracilis* and *A. intertexta*) additional characters such as thallus and ascocarp morphology support the differentiation of the species. In *A. abaphoides* the spore wall is distinctly thickened at the ends (fig. 15) and apart from the excipulum structure (parathecium I+ blue) this character allows a distinction from *A. hololeucoides*. However, in many species the small number of samples available for study makes it difficult to judge on the variability of spore size and septation. The number of spores per ascus is also a useful character and usually corresponds to the spore size.

(2) Chemistry:

Important was the presence of stictic acid or norstictic acid, which do not occur together as major compounds. *Acanthothecis albescens* and *A. intertexta* can be recognized by this difference in chemistry. The occurrence of stictic acid satellites (e. g. cryptostictic acid, constictic acid etc.) was recognized but not taken into consideration for systematic purposes.

Acanthothecis mirabilis and *A. sanguinoloba* are well characterized by the red coloured ascocarps. The pigment responsible for this colouring is isohypocrelline (MATHEY et al. 1994) and appears in other genera (e. g. *Phaeographis haematites*, *Phaeographina montagnei*) as well.

The presence of salazinic acid in *Graphina amicta* and *Graphina marcescens* is not the only diagnostic character, but makes it easy to identify these species as this substance is very rare in Graphidaceae.

Species containing lichexanthone can be distinguished easily due to the bright yellow fluorescence of the thallus under UV light. However, the presence or absence of lichexanthone should not be overestimated in species delimitation. In the species presented here the presence of other lichen acids (norstictic acid, protocetraric acid) as well as morphological data support the presented species concept.

Protocetraric acid is easily detectable too (Pd+ red) and its presence or absence seems to be a good diagnostic character.

Fissurina dumastii contains an unknown substance (see chemistry chapter) which so far has not been found in any other species of the genus.

(3) Excipulum:

Excipulum characters are more important for the generic delimitation than for species delimitation. However, they give additional information and support for the separation of species. For example, the parathecium turns I+ blue in several species. Often the lateral excipulum shows internal striae. Both characters occur in *A. abaphoides* and enable a separation from *A. hololeucoides* even if ascospores are lacking. The carbonization of excipular hyphae is a typical feature of *A. obscura* and separates it from all other *Acanthothecis* species.

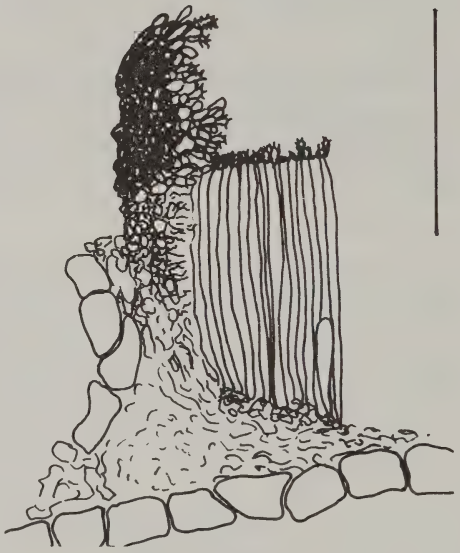


Fig. 16

Fig. 16: *Acanthothecis obscura* [KALB 31314] with distinctly carbonized excipulum; bar = 80 µm

(4) Paraphyses and periphysoids:

If only few species of one genus have warty periphysoids and paraphysis-tips (*Fissurina*, *Graphina*, etc.) this character might be quite specific, too. For example *Chroodiscus brasilianus* is the only species so far known in its genus with this character.

Remarks: We decided to describe three new species following the criteria mentioned above. We are aware of the problem that there is still no monographic treatment of the family. Therefore more than 1000 Graphidaceae species should have been considered before describing new species in order to avoid producing additional synonyms. In the course of this study it was not possible to check all species descriptions nor all types. However, we have examined ca. 200 types from the herbaria of lichenologists who have worked on Graphidaceae and described several new species (Redinger, Nylander, Vainio, Fée, Müller Arg.). We have taken much care to check all species whose descriptions could match our samples (e.g. the red-fruited species in order to find a name for *Acanthothecis mirabilis,* and all species with round-shaped apothecia and muriform ascospores for *A. obscura*).

We have refrained from describing new species, even if they showed conspicuous characters that have not yet been reported, in cases where the material is too scarce. We did not want to publish new species based only on a single collection. Nevertheless, we present descriptions of these species and hope that their taxonomy will be elucidated when more material is available. They are listed with their ad interim names.

3.5. Chemistry

In the following list all species and their chemical compounds are mentioned. It is noticeable that some substances that occur frequently in this group are quite rare in the rest of the family Graphidaceae. This applies for example to protocetraric acid and lichexanthone.

WIRTH & HALE (1963) report that in *Graphina* (= *Acanthothecis*) *hololeucoides* only the ascocarps contain lichen acids (protocetraric acid). We could not confirm this observation as thallus and ascocarps show the same reaction: P+ orange. Only in *Acanthothecis consocians* does the P reaction of the ascocarps (P+ orange) differ from the reaction of the thallus (P-). We could detect traces of psoromic acid in samples containing parts of ascocarps. We routinely used thallus and ascocarps together for the chemical investigations and did not check in all species where the substances are located.

Species	Lichexanthone	Protocetraric acid	Salazinic acid	Norstictic acid	Connorstictic acid	Stictic acid	Peristictic acid	Constictic acid	Menegazziaic acid	Cryptostictic acid	Hypostictic acid	Hypoconstictic acid	Psoromic acid	Isohyopocrelline (red pigment)	? orange (53-58/26/40)	FS (7/2/1)	unknown 38/40/38	
Acanthothecis abaphoides		+																
Acanthothecis albescens						+												
Acanthothecis clavulifera		+																
Acanthothecis consocians													tr					
Acanthothecis corcovadensis						+												
Acanthothecis gracilis				+	+													
Acanthothecis hololeucoides		+																
Acanthothecis incondita						+		+										
Acanthothecis intertexta				+	+	tr												
Acanthothecis leucolyta						+		+										
Acanthothecis leucoxantha						+	+											
Acanthothecis mirabilis														+				
Acanthothecis obscura																		nil
Acanthothecis sanguinoloba														+			+	
Acanthothecis cf. silicicola				+	+													
Acanthothecis tetraphora	+			+	+													
Acanthothecis bicellulata	not analysed																	
Acanthothecis farinosa				+	+													
Acanthothecis subabaphoides	+	+																
Fissurina dumastii															+			
Fissurina instabilis																+		
Graphina amicta			+															
Graphina marcescens		tr	+	tr														
Graphis candidata	+	+																
Graphis chionophora	(+)	+																
Graphis cf. sauroidea						+		+	+		tr							
Phaeographina crassa						+		+		+								
Graphina subalbotecta	+	+																
Chroodiscus brasilianus																		nil
"Kalb 28829"				+														
"Kalb 29942"						+		+										
"Kalb 31325"				+	+													

Table 2: The species and their compounds; + = substance can be found as major or minor compound; (+) substance may be present or absent; tr = substance can be found only in traces; FS = unknown fatty acid.

3.6. The genera and species:

Key to hitherto known species with warty paraphysis-tips and/or warty periphysoids in Graphidaceae sensu lato

1a: Excipulum distinctly and heavily carbonized at least laterally **2**

1b: Excipulum not carbonized or only weakly carbonized or pigmented red **11**

2a: Ascospores muriform or submuriform, i. e. with at least one longitudinal septum **3**

2b: All ascospores transversely septate only **8**

3a: Ascospores 1(–2)/ascus, more than 100 µm (mostly over 150 µm) long ***Phaeographina crassa* Müll. Arg.**

3b: Ascospores 2–8/ascus, shorter than 100 µm **4**

4a: Thallus UV+ yellow (chemical compounds: lichexanthone and protocetraric acid) ***Graphina subalbotecta* ad int.**

4b: Thallus UV- (or not yellow) **5**

5a: Ascospores longer than 15 µm **6**

5b: Ascospores shorter than 15 µm, 4–5/2-celled, I- or faint blue **7**

6a: Hymenium inspersed; ascospores 35–50 × 9-12 µm, I-; no lichen acids present ***Acanthothecis obscura* Staiger & Kalb**

6b: Hymenium not inspersed; ascospores 15–18 × 6–7 µm; salazinic acid present ***Graphina amicta* (Nyl.) Zahlbr.**

7a (5): Excipulum only weakly carbonized at the base (or brownish); spore locules rounded; salazinic acid present ***Graphina marcescens* (Fée) Müll. Arg.**

7b: Excipulum heavily/distinctly carbonized and broadened at the base; lirellae often confluent to larger aggregates; spore locules ± cylindrical; stictic and constictic acids present **KALB 29942**

8a (2): Thallus with protocetraric acid **9**

8b: Thallus with stictic or norstictic acid **10**

9a: Ascospores longer than 50 µm, 15–20-celled (or more) ***Graphis candidata* Nyl.**

9b: Ascospores shorter than 50 µm (20–25 µm), 5–10-celled ***Graphis chionophora* Redinger**

10a (8): Ascospores 4-celled (10–12 × 4–5 µm); norstictic acid present **KALB 28829**

10b: Ascospores 9–14-celled (25–35 × 6–7 µm); stictic, menegazziaic, constictic and hypostictic acids present ***Graphis* cf. *sauroidea* Leight.**

11a (1): Ascospores muriform or submuriform (with at least one longitudinal septum) or only a part of the ascospores submuriform **12**

11b: All ascospores transversely septate only **21**

12a: Excipulum with carbonized parts; hymenium inspersed; ascocarps ± round, margins replicate exposing the disc; ascospores 35–50 × 9–12 µm, 12–14/3–4-celled; no lichen acids present ***Acanthothecis obscura* Staiger & Kalb**

12b: Excipulum not carbonized; hymenium not inspersed; lichen acids present **13**

13a: Protocetraric acid present **14**

13b: Protocetraric acid absent **15**

14a: Ascospores 80–120(–160) × 15–30 µm with thick-walled ends (fig. 15), (1-) 2–4/ascus. Margins bulging, ± crenate; excipulum/hymenium rounded (in cross section!); parathecium I+ blue ***Acanthothecis abaphoides* (Nyl.) Staiger & Kalb**

14b: Ascospores 50–80(–90) × 12–19 µm, without thick-walled ends, 2-8/ascus; margins distinctly crenate - flaky ***Acanthothecis hololeucoides* (Nyl.) Staiger & Kalb**

15a: (13) Ascospores 1 (-2) per ascus **16**

15b: Ascospores more than 4 per ascus **17**

16a: Norstictic acid as major compound, only few ascospores with longitudinal septa (no real septa but plasmodesma), no Graphidaceae (fig. 2) **KALB 31325**

16b: Stictic acid, constictic acid, hypoconstictic acid and other stictic acid satellites present; ascospores distinctly muriform ***Acanthothecis corcovadensis* (Redinger) Staiger & Kalb**

17a (15): Thallus UV+ yellow, chemical compounds lichexanthone, norstictic acid, connorstictic acid; ascospores longer than 60 µm (60–90 × 14–18 µm) ***Acanthothecis tetraphora* (Nyl.) Staiger & Kalb**

17b: Thallus UV- (or not yellow); ascospores shorter **18**

18a: Ascospores I+ blue-violet; chemical compound fatty acid; neat fissurine lirellae with ± exposed disc ***Fissurina instabilis* (Nyl.) Nyl.**

18b: Ascospores I-; stictic acid or norstictic acid as major compounds **19**

19a: Norstictic acid and connorstictic acid present; ascospores submuriform (8–12/1–2-celled, 20–32 × 6–8 µm), often one end tapering; thallus thin, greyish ***Acanthothecis gracilis* Staiger & Kalb**

19b: Stictic acid and constictic acid present, ascospores rounded, distinctly muriform, ellipsoid **20**

20a: Ascospores 22–30 × 9–12 µm, 7–10/3-celled ***Acanthothecis leucolyta* (Nyl.) Staiger & Kalb**

20b: Ascospores larger, 30–37 × 12–14 µm, 10–11/3–5-celled ***Acanthothecis incondita* (Nyl.) Staiger & Kalb**

21a (11): Ascocarps coloured dark red, K+ (section); red granules dissolving with green "cloud", isohypocrelline **22**

22a: Spores 4-celled **Acanthothecis sanguinoloba (Redinger) Staiger & Kalb**

22b: Spores 10–13-celled ***Acanthothecis mirabilis* Staiger & Kalb**

21b: Ascocarps not dark red, not K+ as above **23**

23a: Ascospores 2-celled, fusiform; ascocarps round to oval rarely oblong, margins reflexed ***Acanthothecis bicellulata* ad int.**

23b: Ascospores more than 2-celled **24**

24a: Ascospores 1/ascus, 120–150 × 20–30 µm, no Graphidaceae **KALB 31325**

24b: Ascospores 2–8/ascus **25**

25a: Protocetraric acid present; ascospores longer than 50 µm **26**

25b: Protocetraric acid absent; ascospores shorter than 50 µm **27**

26a: Thallus UV+ yellow (chemical compounds protocetraric acid and lichexanthone); parathecium I+ blue, excipulum laterally striate, disc slit-like ***Acanthothecis subabaphoides* ad int.**

26b: Thallus UV-, chemical compound: protocetraric acid, margins irregularly bulging; disc ± exposed ***Acanthothecis clavulifera* (Vain.) Staiger & Kalb**

27a (25): Norstictic acid present **28**

27b: Norstictic acid absent **30**

28a: On rock; periphysoids and paraphysis-tips not distinctly warty ***Acanthothecis silicicola* (Redinger) Staiger & Kalb**

28b: On bark or wood **29**

29a: Ascospores 11–17-celled, 30–45 × 5–7.5 µm, I- ***Acanthothecis intertexta* (Müll. Arg.) Staiger & Kalb**

29b: Ascospores smaller, 6–9-celled, 20–25 × 5–7 µm, I+ faint blue, thallus powdery, cortex lacking ***Acanthothecis farinosa* ad int.**

30a (27): Thallus with few to many oblong isidia; apothecia round to oval or star-like, margins reflexed, inner sides of the margins white pruinose ***Chroodiscus brasilianus* (Hale) Staiger & Kalb**

30b: Thallus without isidia; ascocarps ± oblong **31**

31a: Stictic acid present **32**

31b: Stictic acid absent **33**

32a: Ascospores 12–14-celled, 36–45 × 6–7 µm, oblong-vermiform ***Acanthothecis albescens* (Vain.) Staiger & Kalb**

32b: Ascospores 6–10-celled, 20–30 × 5–6 µm, often one end tapering ***Acanthothecis leucoxantha* (Müll. Arg.) Staiger & Kalb**

33a (31): Ascospores 4-celled ***Fissurina dumastii* Fée**

33b: Ascospores 6–9-celled ***Acanthothecis consocians* (Nyl.) Staiger & Kalb**

3.6.1. *Acanthothecis* Clem.

CLEMENTS, F. E. The genera of fungi: 59 (1909).

Lectotype of the genus (CLEMENTS & SHEAR 1931): *Acanthothecis pachygraphoides* (Vain.) Clem. = *Acanthothecium pachygraphoides* Vain. **(= *Acanthothecis hololeucoides* (Nyl.) Staiger & Kalb)**.

Lectotype: Brazil, Minas Gerais, Sitio, 1885. E. A. Vainio, Lichenes Brasilienses exsiccati (1892) No. 876. TUR-V 27023!

= *Acanthothecium* Vain. (non Spegazzini 1889).

VAINIO, E. V. Acta Soc. Fl. Fenn. 7(2): 93 (1890).

= *Psorographis* Clem.

CLEMENTS, F. E. The genera of fungi: 59, 174 (1909).

Type: *Psorographis clavulifera* (Vain.) Clements ("*clavuliger*") = *Acanthothecium clavuliferum* Vain.

= *Acanthotheciopsis* Zahlbr.

ZAHLBRUCKNER, A. Cat. Lich. Univ. II: 448 (1923).

= *Acanthographis* Walt. Watson

WATSON, W. New Phytol. 28: 96 (1929).

Type: *Acanthothecium clavuliferum* Vain.

= *Acanthographina* Walt. Watson

WATSON, W. New Phytol. 28: 96 (1929).

Lectoype (CLEMENTS & SHEAR 1931: 307): *Acanthothecium pachygraphoides* Vain.

Thallus: Light-grey yellowish, dull, sometimes roughened, slightly cracked, cortex developed but not as thick as in *Fissurina* and without a distinct layer of periclinal hyphae; **phycobiont:** *Trentepohlia.*

Ascocarps: Concolourous with the thallus or slightly paler, mostly oval to oblong lirellae with slit-like or little opened disc. Margins rough, mealy, in some species crenate.

Excipulum: Uncarbonized, to slightly carbonized (*A. obscura*), often at the base poorly developed. The lateral excipulum and the margins are sometimes greyish consisting of dead hyphae and small granules (probably incrusted lichen acids). In several species new hymenia can develop below the old ones (e.g. *A. hololeucoides*) leading to crenate margins and striate excipula as the old margins are pushed to the sides.

Hymenium: 80–150 µm high, in transverse section trapezium-like or rounded.

Paraphyses: In most species with distinctly warty tips, hyaline, not connected and unbranched, ± parallel, closely neighboured.

Periphysoids: Warty or spiny (in some species difficult to detect as the warts may be short and irregular) emerging at the inner side and at the edges of the margins, continuing in some species to the lateral parts of the excipulum, 10–50 µm long.

Ascus: 2–8-spored, "*Graphis*-type".

Ascospores: Oblong, hyaline, muriform or with transverse septa only but never ovoid, I-, I+ light-blue or I+ violet. Spore locules in transversely septate spores mostly cylindrical and rarely lens-shaped.

Pycnidia: Not seen.

Remarks:

(1) The type species of all genera listed as synonyms are either *A. clavulifera* or *A. pachygraphoides* (= *A. hololeucoides*). Both species share all the important generic characters and differ only in ascospore size and septation. Therefore they must belong to one genus.

(2) Warty paraphyses and periphysoids are not restricted to the genus *Acanthothecis*. The other way round it is not the only generic characteristic and

therefore not all species of the genus show it. For example *A. silicicola* does not show distinctly warty periphysoids but shares all other typical characters of the genus such as excipulum anatomy and ascocarp development. Hence it is justified to assign this species to *Acanthothecis*, too.

(3) From the closest genus *Fissurina*, *Acanthothecis* is separated by a different spore type (distinctly thickened septa with rounded lumina in *Fissurina* versus thin septa, resulting in cylindrical lumina in *Acanthothecis*), a rather thick, corticated thallus in *Fissurina* versus a thallus with a thin, sometimes lacking cortex in *Acanthothecis* and ± sessile ascocarps which are provided with distinct margins in *Acanthothecis* while these are „fissurine“ and margins mostly lacking in *Fissurina*.

Key to the species of the genus *Acanthothecis*:

1a: Ascocarps with carbonized margins; excipulum carbonized or brownish, hymenium inspersed with oil drops; no lichen acids present (fig. 16) ***Acanthothecis obscura* Staiger & Kalb**

1b: Excipulum not carbonized, at most brownish; hymenium not inspersed with oil drops **2**

2a: Ascocarps dark red, isohypocrelline (red pigment) present, in section K + red granules dissolving with green colour **3**

2b: Ascocarps not red coloured, red pigment absent **4**

3a: Spores 10–13-celled ***Acanthothecis mirabilis* Staiger & Kalb**

3b: Spores 4-celled ***Acanthothecis sanguinoloba* (Redinger) Staiger & Kalb**

4a: Thallus UV+ yellow (lichexanthone present) **5**

4b: Thallus UV- or not yellow (lichexanthone absent) **6**

5a: Ascospores with transverse septa only, 20–30-celled, 65–85 × 9–11 µm; protocetraric acid, lichexanthone present ***Acanthothecis subabaphoides* ad int.**

5b: Ascospores muriform; periphysoids develop from the upper side of the margin; norstictic acid, connorstictic acid, lichexanthone present ***Acanthothecis tetraphora* (Nyl.) Staiger & Kalb**

6a (4): Thallus or at least ascocarps Pd + red (protocetraric acid present) **7**

6b: Thallus and ascocarps Pd - or Pd + not red (protocetraric acid absent) **9**

7a: Ascospores with transverse septa only, 35–75-celled, 85–115 × 8–13 µm, ***Acanthothecis clavulifera* (Vain.) Staiger & Kalb**

7b: Ascospores muriform **8**

8a: Ascospores with bonnet-like apical thickening of the cell wall (fig. 15), 27–35/4–5-celled, 85–165 × 13–30 µm; parathecium I+ blue; hymenium ± rounded (in cross section!) ***Acanthothecis abaphoides* (Nyl.) Staiger & Kalb**

8b: Ascospores without bonnet-like, apical thickening of the cell wall, 20–35 × 2–4-celled, 67–95 × 12–19 µm; hymenium trapezium like

(in cross section!)

***Acanthothecis hololeucoides* (Nyl.) Staiger & Kalb**

9a (6): Ascospores 2-celled, fusiform; ascocarps round to oval rarely oblong

***Acanthothecis bicellulata* ad int.**

9b: Ascospores more than 2-celled; ascocarps ± oblong **10**

10a: Ascospores muriform or submuriform (also those with only one longitudinal septum or only few muriform ascospores) **11**

10b: Ascospores with transverse septa only **14**

11a: Ascospores submuriform (8–12/1–2-celled, 20–32 × 6–8 μm); norstictic and connorstictic acids present.

***Acanthothecis gracilis* Staiger & Kalb**

11b: Ascospores distinctly muriform; stictic acid as major chemical compound present **12**

12a: Spores 1 (-2) per ascus, exceeding 50 × 15 μm

***Acanthothecis corcovadensis* (Redinger) Staiger & Kalb**

12b: Spores 8 per ascus, not exceeding 50 × 15 μm **13**

13a: Ascospores 7–10/3–5-celled, 22–30 × 9–12 μm

***Acanthothecis leucolyta* (Nyl.) Staiger & Kalb**

13b: Ascospores larger, 10–11/3–5-celled, 30–37 × 12–14 μm

***Acanthothecis incondita* (Nyl.) Staiger & Kalb**

14a (10): Norstictic acid present **15**

14b: Norstictic acid absent **17**

15a: On rock (saxicolous); ascospores 6-celled, 19–22 × 6 μm; periphysoids not distinctly warty

***Acanthothecis silicicola* (Redinger) Staiger & Kalb**

15b: On bark or wood; periphysoids distinctly warty **16**

16a: Ascospores more than 10-celled, longer than 30 μm

***Acanthothecis intertexta* (Müll. Arg.) Staiger & Kalb**

16b: Ascospores shorter than 30 μm, 6–9-celled, I+ faint blue; thallus mealy, cortex lacking ***Acanthothecis farinosa* ad int.**

17a (13): Ascospores 12–14-celled, 35–45 × 6–7 μm; stictic acid present

***Acanthothecis albescens* (Vain.) Staiger & Kalb**

17b: Ascospores shorter than 35 μm **18**

18a: Ascospores 6–9-celled, 13–18 × 4–5 μm, I-; psoromic acid present (in the ascocarps only - the small amounts are difficult to detect with TLC)

***Acanthothecis consocians* (Nyl.) Staiger & Kalb**

18b: Ascospores 6–10-celled, 20–30 × 5–6 μm, I+ faint blue; stictic acid (and peristictic acid) present

***Acanthothecis leucoxantha* (Müll. Arg.) Staiger & Kalb**

Species:

Acanthothecis abaphoides (Nyl.) Staiger & Kalb comb. nov.

≡ *Graphis abaphoides* Nyl. in Eckfeldt, Bull. Torrey Bot. Club. 16: 105 (1889).

Holotype: U.S.A., Florida, Jacksonville on *Persea*, Eckfeldt and Calkins 107. H-NYL 6862! (Protocetraric acid fide annotation by Nakanishi 1973).

≡ *Graphina abaphoides* (Nyl.) Müll. Arg., Bull. Herb. Boissier III (2): 46 (1895).

= *Graphina atractospora* Redinger, Ark. Bot. 26 A (1): 71 (1933).

Lectotype (designated here): Brazil, Matto Grosso, Cuyabá. Corticola in "cerrado" pr. oppidum. No. 2022 S! (Protocetraric acid).

Syntype: dto. 2022 B S!

Fig.: 17 and 18.

Thallus: Light-grey, uneven or with small warts, slightly fissured.

Ascocarps: Short, ± branched lirellae (ca. 2–4 × 0.4–0.7 mm). Thalline margins bulging and slightly crenate, paler than the thallus and slightly raised. Disc concealed in the slit formed by the margins.

Excipulum: Uncarbonized, at the base partly poorly developed, laterally very distinct, striate. New hymenia can develop below the old ones pushing them aside (fig. 18). The parathecium turns I+ blue.

Hymenium: Ca. 130 µm high.

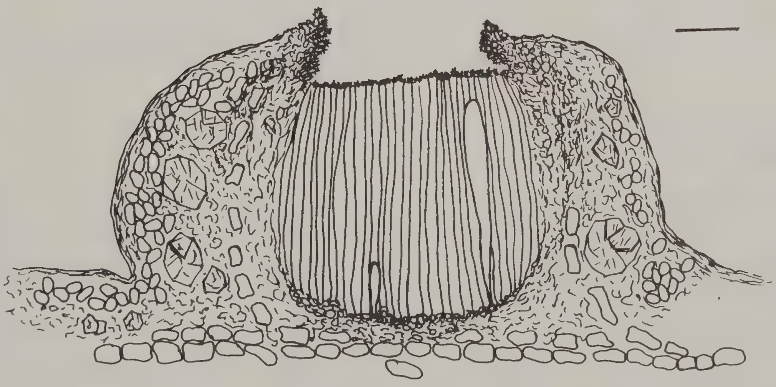


Fig. 17

Fig. 17: *Acanthothecis abaphoides* [KALB 31324], section through young ascocarp; bar = 40 µm

Paraphyses: Ca. 1.5–2 µm thick, tips distinctly warty. **Periphysoids** develop at the edge of the margin/the lengthening of the parathecium. They are short (5–10 µm) and warty.

Ascospores: 1–4/ascus, hyaline, muriform, cell wall thickened (hood-like) at the ends (fig. 15) 27–34/4–5-celled, 84–165 × 13–30 µm, I-.

Chemistry: Protocetraric acid.

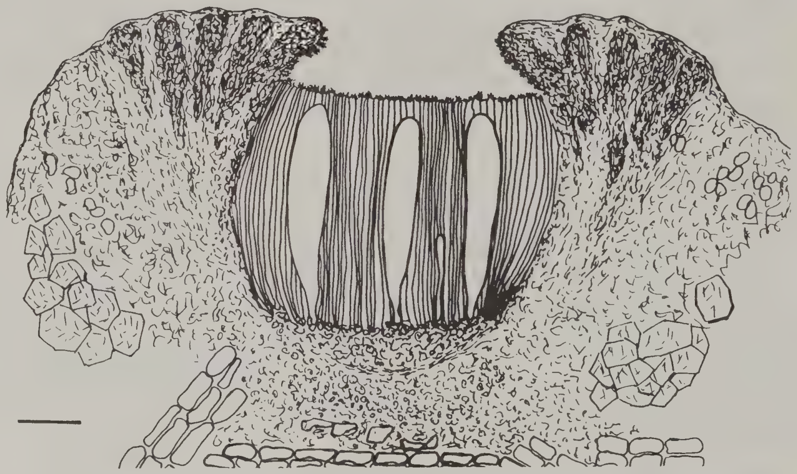


Fig. 18

Fig. 18: *Acanthothecis abaphoides* [KALB 31324], section through old ascocarp with striate excipulum; bar = 40 µm

Specimens examined:

SOUTH AMERICA

Brazil: Mato Grosso: See type specimens of *Gr. atractospora*. - **Mato Grosso do Sul:** Bei Bandeirantes, etwa 72 km N von Campo Grande, in einem Cerradão. 700 m. XI.1979. K. Kalb 31346 (KALB). **Bahia:** Chapada Diamantina, Serra do Tombador, zwischen Mundo Novo und Morro do Chapéu. 1000 m. VII. 1980. K. Kalb 31331 (KALB). - dto. 31328 (KALB). **Minas Gerais:** Lagoa Santa. Warming 41/42 (M).- Etwa 50 km N von Fernandópolis am Rio Grande, an verschiedenen Laubbäumen, in einem Cerradão. 500 m. X. 1979. K. Kalb & G. Plöbst 31324 (KALB). - **São Paulo:** Fazenda 13. de maio, 18 km N von Botukatu und 14 km E von São Manuel, in einem Cerradão; an *Byrsonima coccolobaefolia*. 550 m. XI. 1979. K. Kalb & G. Plöbst 31327 (KALB). - dto.; an *Adenanthera falcata*. 31326 (KALB). - dto.; an *Stryphnodendron barbatimam* 31322 (KALB). - dto.; an *Eugenia* spec. 31330 (KALB). - dto.; an *Eugenia* spec. 31341 (KALB). - dto.; an *Guapira cafferana* 31323 (KALB). - Serra do Córrego Fundo, bei Luís Antonio, etwas 50 km S von Riberão Preto, in einem alten Cerradão. 550 m. VI. 1979 K. Kalb & G. Plöbst 28840 (KALB). - Municipio Moji Guaçu, Bairro Martinho Prado Jr., Reserva Biológica de Moji-Guaçu, dichter Cerrado. 560 m. VIII. 1995. B. Marbach & M. Marcelli (KALB).

Paraguay: Colonia Risso, in silva clara, loco subhumido, 11.10. 1893. G. A. Malme 1890f (S) - Syntype of *Graphina incerta* Redinger but not corresponding to the description.

Remarks:

(1) *Graphina atractospora* Redinger corresponds in all characters with *Acanthothecis abaphoides*.

(2) The specimen Malme 1890f is the syntype of *Graphina incerta* Redinger, but it does not correspond to Redinger's description. This fact was previously mentioned by WIRTH & HALE (1963).

(3) *Acanthothecis abaphoides* resembles *Acanthothecis hololeucoides* in several characters, but differs mainly in:

- The ascospores in *A. abaphoides* are larger and have a hood-like thickening of the cell wall at both ends.
- The development of new hymenia seems to differ as the lateral excipulum is distinctly striate in *A. abaphoides* (fig. 18) whereas in *A. hololeucoides* the striae of the excipulum are not well developed. Instead the margins are often "flaky". We presume that the old hymenia are pushed to the side in *A. abaphoides* and pushed upwards in *A. hololeucoides* forming the cover of the new ascocarp.

(4) Ascospore size depends on their number per ascus. In this species we have found 1-4 spores per ascus and therefore a large amplitude of variation in spore size.

Acanthothecis albescens (Vain.) Staiger & Kalb comb. nov.

≡ *Graphis albescens* Vain., Étud. Lich. Brésil. Acta Soc. Fauna Fl. Fenn. 7(2): 124. (1890).

Holotype: Brazil, Minas Gerais, Sitio, ad corticem arboris, 1885. E. A. Vainio, Lichenes Brasilienses exsiccati (1892) No. 621. TUR-V 27745! (Stictic acid, fide annotation by Wirth 1961).

Fig.: 19.

Thallus: Light-grey to cream-coloured, dull, slightly warty and uneven. Many Ca-oxalate crystals are in the medulla.

Ascocarps: Short to oblong (1–3 × 0.3–0.5 mm), slightly flexuose, rarely branched. Thalline margins paler than the thallus ± raised, forming a slit. The disc is not visible in surface view (concealed).

Excipulum: Uncarbonized, consisting of yellowish hyphae at the base, the hymenium seems to be embedded in the thallus, segregated only by a thin layer of excipular hyphae.

Hymenium: Ca. 100 µm high.

Paraphyses: Ca. 1 µm thick, with warty tips that jut ca. 10 µm above the hymenium. The **periphysoids** emerge from the edge of the thalline margin. They are quite long (30–50 µm) and distinctly warty.

Ascospores: 8/ascus, hyaline, with transverse septa only, 12–14-celled, 36–45 × 6–7 µm, I+ light-blue to faint violet. Spore locules lens-shaped.

Chemistry: Stictic acid.

Specimens examined:

SOUTH AMERICA

Brazil: Minas Gerais: See type specimen.

Remarks:

(1) As we examined only the type specimen of *Acanthothecis albescens* it was not possible to gauge the variability of ascospore size and excipular characters. *Acanthothecis leucoxantha* is similar with respect to chemistry and habitus but differs in smaller ascospores.

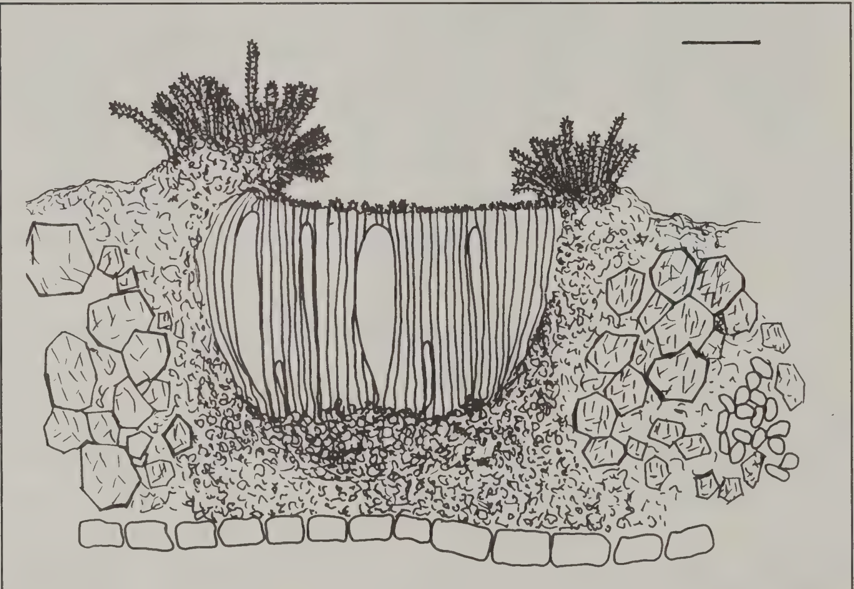


Fig. 19

Fig. 19: *Acanthothecis albescens* [TUR-VAIN. 27745]; bar = 40 µm

Acanthothecis clavulifera (Vain.) Staiger & Kalb comb. nov.

≡ *Psorographis clavulifera* ("*clavuliger*") (Vain.) Clem., The genera of fungi: 174 (1909).

≡ *Acanthothecium clavuliferum* Vain., Acta Soc. Fauna Fl. Fenn. 7(2): 95 (1890).

Lectotype (designated here; proposed by Aino Henssen VIII 1980 - annotation label, but never published): Brazil, Minas Gerais, Sitio, 1885. E. A.

Vainio, Lichenes Brasilienses exsiccati (1892) No. 523. TUR-V 27019! (Protocetraric acid).

Syntype: Brazil, Minas Gerais, Carassa, 1885. E. A. Vainio, Lichenes Brasilienses exsiccati (1892) No. 1197. M! (Protocetraric acid).

Thallus: Light-grey, cream-coloured, bumpy, ± cracked.

Ascocarps: Oval to oblong (1–3.5 × 0.5–0.7 mm), lirellae partly branched, distinctly separated from the thallus (sessile), margins bulging, whitish-yellow, disc exposed, with white pruina.

Excipulum: Uncarbonized, poorly developed at the base, laterally grey, consisting of hyphae that cannot be stained with Lactophenol-cottonblue.

Hymenium: 120–150 µm high.

Paraphyses: Hyaline, in the upper part sometimes yellow-orange, tips warty, projecting ca. 5 µm over the hymenium. **Periphysoids** warty, growing out of the inner side of the margin, continuing (with smooth surface) beneath the hymenium.

Ascospores: 3–8/ascus, hyaline, with transverse septa only, 36–47-celled, 85–117 × 8–13 µm, with halo 3-5 µm at least in younger spores, I-, spore locules cylindrical (fig. 13).

Chemistry: Protocetraric acid.

Specimens examined:

SOUTH AMERICA

Venezuela: Distr. Campo Elias, el Pedregal, etwa 50 km NW von Mérida. 8° 40' N, 71° 05' W, an niedrige Felsblöcken in einem Moor bzw. anschließenden Wolkenwaldresten. 2000 m. VIII. 1989. K. Kalb & M. Lopez-Fig. 22721 (KALB).

Brazil: Minas Gerais: See type specimens.

Acanthothecis consocians (Nyl.) Staiger & Kalb comb. nov.

≡ *Graphis consocians* Nyl., Bull. Soc. Linn. Normand., ser. 2, 2: 116 (1868).

Holotype: Nova Caledonia, Lifu, Loyalty insularum, ad corticem arboris, 1864, leg. Thiébaut. H-NYL 7639! (Annotation by Nakanishi 1972: No substances present, unknown?).

Thallus: White to yellowish, coarse-grained due to many Ca-oxalate crystals in the mark. In one of the samples examined the cortex seems to be cropped.

Ascocarps: Whitish, paler than the thallus, oblong, branched lirellae, sometimes densely crowded, more or less opened thalline fissures with distinct pale pruinose inner margins.

Excipulum: Uncarbonized, lateral and at the base formed by yellowish to red-brown hyphae, thalline margin like the thallus with a lot of crystals.

Hymenium: 40-70 µm high.

Paraphyses: Paraphysis-tips warty. **Periphysoids** long (20 µm), distinctly warty as well.

Ascospores: 8/ascus, hyaline, with transverse septa only, 6–9-celled 13–18 × 4–5 µm, I-; spore locules lens-shaped.

Chemistry: Traces of psoromic acid; restricted to the ascocarps.

Specimens examined:

ASIA-TROPICAL

Malesia: Papua-New Guinea: Madang prov. Balek Wildlife Reserve 15 km S of Madang along road to Lae, tropical rainforest. 20 m. 145°43'E; 5°18'S. III. 1987. A. Aptroot 17721 (KALB 29316).

PACIFIC

South Western Pacific: New Caledonia: See type specimen.

Remarks:

(1) Similar to *A. leucoxantha* differing in the presence of psoromic acid in the ascocarps and smaller ascospores.

Acanthothecis corcovadensis (Redinger) Staiger & Kalb comb. nov.

≡ *Graphina corcovadensis* Redinger, Ark. Bot. 26 A (1): 70 (1933).

Holotype: Brazil, Rio de Janeiro, Corcovado,14.8.1892, leg. G. A. Malme Nr. 41. S! (Stictic acid, fide annotation by Wirth 1961).

Thallus: Quite variable, light-grey to yellow-grey , dirty-grey, dull, distinctly warty, slightly fissured or fissured-areolate.

Ascocarps: Short to little oblong, rarely branched lirellae, paler than the thallus and mostly distinctly raised above the thallus. Margins bulging, disc not visible. The slit is often yellowish coloured and felt-like.

Excipulum: Uncarbonized, the lateral excipulum is usually striate; substratum and crystals can be integrated in the excipulum. The inner layer of the excipulum (parathecium) turns I+ blue.

Hymenium: 130-180 µm high.

Paraphyses: Thickened at the tips and sometimes subapically, not warty, laterally often anastomosing. **Periphysoids** develop from the thalline margin and grow into the slit-like opening of the ascocarp. They form the felt-like yellowish layer that covers the inner parts of the margins. The periphysoids can reach more than 40 µm in length (fig.7).

Ascospores: 1/ascus, hyaline, muriform, ca. 20–40/6–10-celled, 90–120 × 20–36 µm, I-. At least young ascospores show a gelatinous layer of 1–3 µm.

Chemistry: Stictic acid, constictic acid, cryptostictic acid, hypostictic acid, hypoconstictic acid, α-acetylconstictic acid.

Specimens examined:

SOUTH AMERICA

Brazil: **Bahia:** Serra das Mangabeiras, etwa 8 km vor Seabra, in einem Cerradão.

1050 m. VII. 1980. K. Kalb 28837 (KALB). - **Rio de Janeiro:** Serra da Mantiqueira, Itatiaia, Parque National do Itatiaia. VII. 1978. K. Kalb & G. Plöbst 31281 (KALB). - **São Paulo:** Serra do Mar, Serra de Paranapiacaba, 60 km SW von São Paulo, oberhalb von Juquitiba, in einem hellen, feuchten Urwald an einem Stausee. 550 m. V. 1978. K. Kalb & G. Plöbst 31318 (KALB). - dto. 31321 (KALB). - Serra do Mar, Serra de Paranapiacaba, 60 km SW von São Paulo, oberhalb von Juquitiba, in einem hellen, feuchten Urwald am Rio Juquiá. 660-800 m. V. 1978. K. Kalb & G. Plöbst 31308 (KALB). - Serra do Mar, Serra de Paranapiacaba, 40 km SW von São Paulo, in einem dunklen, feuchten Urwald . 800 m. III. 1978. K. Kalb & G. Plöbst 31351 (KALB).

Remarks:

(1) The type specimen shows only short periphysoids. Probably the long periphysoids have broken. The ascocarps seem to be cropped.

Acanthothecis gracilis Staiger & Kalb spec. nov.

Similis *A. intertextae,* sed imprimis differt ascosporis brevioribus et submuriformibus.

Holotype: U.S.A. Louisiana, Baton Rouge, Baird Drive, on Parsley Haw (*Crataegus marshallii*). V. 1989, leg.: S. Tucker 29368. (Herb. K. KALB 24569 – Holotypus). (Norstictic and connorstictic acids).

Fig.: 20 - 21.

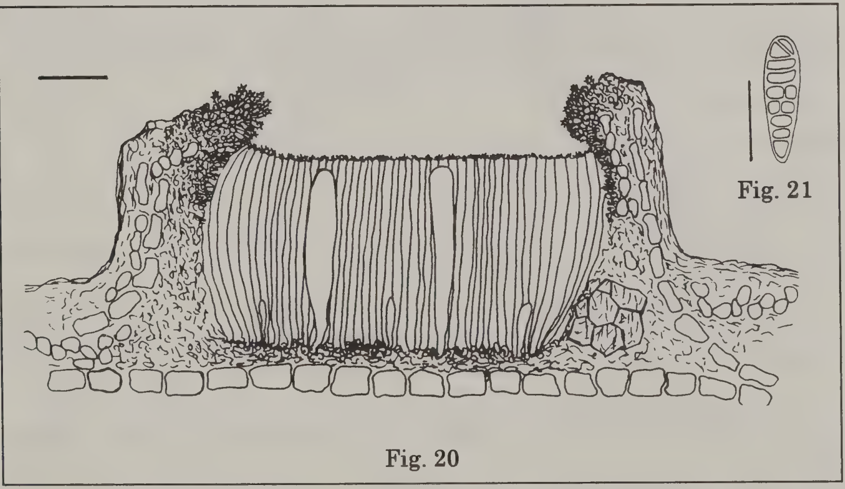


Fig. 20 - 21: *Acanthothecis gracilis* [KALB 30438] (fig. 20); bar = 30 µm, spore (fig. 21); bar = 20 µm

Thallus: Thin, whitish (-grey) or cream-coloured, dull, rough and slightly cracked.
Ascocarps: Concolourous with the thallus, short, delicate, fissurine lirellae (1 × 0.2–0.4 mm), ± branched, irregularly flexuose. Margins little bulging or

vaulted; disc little opened, light-grey, indistinctly whitish pruinose.

Excipulum: Uncarbonized, only the edges of the thalline margins can be brownish. At the base excipulum poorly developed, laterally with parts of the substratum (bark cells) and sometimes crystals integrated.

Hymenium: 70–90 µm high.

Paraphyses: Ca. 1.5 µm thick, tips slightly thickened, brownish and distinctly warty. **Periphysoids** warty, developing at the innner sides of the margins and continuing beneath the hymenium as short hyphae without warts.

Ascospores: 8/ascus, hyaline, submuriform, 8–12/1–2-celled, 20–32 × 6–8 µm, partly with thin (ca. 1 µm) halo, I-. Spore locules rounded (fig. 21).

Chemistry: Norstictic acid, connorstictic acid.

Specimens examined:

AFRICA

Western Indian Ocean: Réunion: Zwischen le Brûlé (S von St-Denis) und Plaine des Cnicots. Tropischer Regenwald mit *Nastus borbonicus*, *Acacia heterophylla*, *Cyathea borbonica*, *Philippia montana* etc. 1400-1600 m. 20°57'S, 55°27'E. VIII. 1991. K. & A. Kalb. 26152 (KALB).

AUSTRALASIA

Australia: New South Wales: Brown Mtn., ca. 30 km SE of Nimmitabel. Wet sclerophyll forest with scattered remnant rainforest with *Cyathea*, *Acacia*, etc. 850 m. VIII. 1994. K. & A. Kalb & J. Elix. 30438 (KALB).

NORTHERN AMERICA

Southeastern U.S.A.: Louisiana: See type specimen.

Remarks:

(1) Two other species are quite similar:
A. intertexta differs in longer, thinner ascospores without longitudinal septa, larger ascocarps and a thicker thallus.
A. leucoxantha is distinguishable by different chemical compounds (stictic and peristictic acid instead of norstictic and connorstictic acid) and ascospores that turn faint blue with I.

Acanthothecis hololeucoides (Nyl.) Staiger & Kalb comb. nov.

≡ *Graphis hololeucoides* Nyl., Ann. Sci. Nat., sér. 4 (Bot.), 20: 266 (1863).

≡ *Graphina hololeucoides* (Nyl.) Müll. Arg., Flora 65: 397. (1882).

Holotype (annotation label by Wirth 1961: Isotype): Mexico, ad corticem, leg. Ghiesbreght, ex. Mus. Paris. H-NYL 6811! (Annotation by Wirth 1961: Ascocarps Pd+, protocetraric acid suspected but not proven).

= *Acanthothecis pachygraphoides* (Vain.) Clem.

CLEMENTS, F. E. The genera of fungi: 59 (1909).

≡ *Acanthothecium pachygraphoides* Vain., Acta Soc. Fauna Fl. Fenn. 7(2): 94 (1890).

Lectotype (designated here; proposed by Aino Henssen VIII 1980 - annotation label, but not published): Brazil, Minas Gerais, Sitio, 1885. E. A. Vainio, Lichenes Brasilienses exsiccati (1892) No. 876. TUR-V 27023! (Protocetraric acid).

Isolectotype: M! (Protocetraric acid).

= *Acanthothecis caesiocarnea* (Vain.) Kalb

KALB, K. Lichenes neotropici. Fascikel III: 3 (1982).

≡ *Acanthothecium caesiocarneum* Vain., Acta Soc. Fauna Fl. Fenn. 7(2): 94 (1890).

Lectotype (designated here; proposed by Aino Henssen VIII 1980 - annotation label but not published): Brazil, Minas Gerais, Sitio, 1885. E. A. Vainio, Lichenes Brasilienses exsiccati (1892) No. 1099. TUR-V 27026!

Fig.: 22.

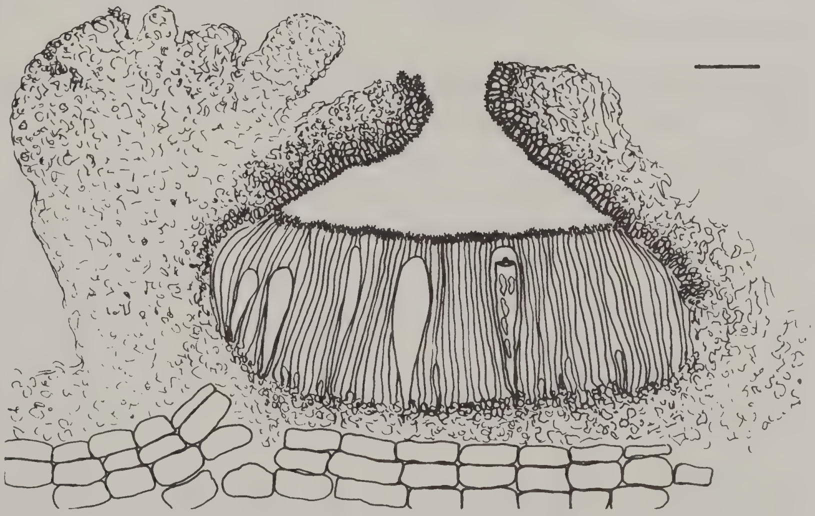


Fig. 22

Fig. 22: *Acanthothecis hololeucoides* [TUR-VAIN.27023]; bar = 40 µm

Thallus: Light-grey, yellowish grey, dull, bumpy/uneven, ± cracked or discontinuous (probably due to growth of the substratum).

Ascocarps: Rounded or oval to ± oblong (1–3 × 0.6–1mm), rarely branched lirellae. Margins slightly bulging, mostly crenate and sometimes cracked, concolorous with the thallus or slightly paler to yellowish. Discs more or less exposed, whitish pruinose.

Excipulum: Uncarbonized, poorly developed at the base, distinct ”thalline” margins - the inner striae consist of the old, degraded hymenia. Only the outer layer contains algae and is a real thalline margin.

Hymenium: 100–130 µm high. New hymenia can develop below the old ones.

Paraphyses: With warty tips, jutting out of the hymenia (10 µm). **Periphysoids** 10–20 µm long, with distinct warty surface as well. The periphysoids have a continuation (not warty) at the side of the excipulum.

Ascospores: 3–8/ascus, hyaline, muriform, 20–35/2–4-celled, 67–96 × 12–19 µm, I-.

Chemistry: Protocetraric acid (ascocarps and thallus).

Specimens examined:

NORTHERN AMERICA

North and Central Mexico: See type of *A. hololeucoides* (exact location not indicated).

SOUTH AMERICA

Costa Rica: Cartago, Cordillera de Talamanca, Interamerican Highway, 11 km S von Cartago, 9° 48' N, 83° 55' W. Untere Bergregenwaldstufe. 1650 m. XII. 1978. K. Kalb & G. Plöbst. 31317 (KALB). - dto. 31342 (KALB).

Guatemala: Baja Verapaz, Nationalstraße 17 etwa 10 km S von La Unión Barros; an *Pinus*. 1500 m. II. 1979. K. Kalb & G. Plöbst. 31334 (KALB). - Alta Verapaz, Nationalstraße 17 bei Tactic, etwa 20 km S von Coban, an Weidebäumen und Weidezäunen in staunassen Weiden. 1350 m. II. 1979. K. Kalb & G. Plöbst 30918* (KALB).

Brazil: **Bahia:** Chapada Diamantina. Serra do Tombador, zwischen Mundo Novo und Morro do Chapéu. 1000 m. VII. 1980. K. Kalb. 31350 (KALB). **Minas Gerais**: K. Kalb, Lich. Neotropici, 82. Serra da Mantiqueira; Vila Monte Verde, etwa 30 km O von Camanducaia, an einem Laubbaum in einem Bergregenwald, 1800 m. IX. 1978. K. Kalb & G. Plöbst. (KALB). - Serra do Espinhaço, Serra do Caraça, Bocaina, etwa 4 km E des Klosters. 1450 m. VII. 1978. K. Kalb & G. Plöbst 31339 (KALB). - dto. 31352 (KALB). - Serra do Espinhaço, Serra do Caraça, Umgebung des Klosters Caraça (Hauptsammelgebiet von Vainio). VII. 1978. K. Kalb & G. Plöbst 31387 (KALB). - **São Paulo:** K. Kalb, Lich. Neotropici, 81. Bezirk Anhembi, Fazenda Barrero Rico, Cerrado-Insel in einem feuchten Primärregenwald, an Solanum spec., 450 m. XI. 1979. K. Kalb & G. Gottsberger (KALB). - Serra do Mar, Serra de Paranapiacaba, 40 km. SW von São Paulo, in einem dunklen, feuchten Urwald. 800 m. III. 1978. K. Kalb & G. Plöbst 31347 (KALB). - Serra do Mar, Serra de Paranapiacaba. 60 km. SW von São Paulo, oberhalb von Juquitiba, in einem hellen, feuchten Urwald an einem Stausee. 550 m. V. 1978. K. Kalb & G. Plöbst 31338# (KALB). - Serra de São Lourenço, NW von São Lourenço da Serra, in einem feuchten, schattigen, sekundären Hangwald. 850 m. IX. 1978. K. Kalb & G. Plöbst. 31314 (KALB). - dto. 31353 (KALB). - dto. 31319 (KALB). - dto. 31316 (KALB). - Praia de Peruibe bei Itanhaém, in einem dichten Stranddünenwald (Restinga). 5 m. II. 1979. K. Kalb & G. Plöbst. 31340 (KALB). - Fazenda 13. maio, 18 km N von Botukatu und 14 km O von São Manuel, in einem Cerradão. 550 m. XI. 1979. K. Kalb & G. Plöbst 31336 (KALB). - Bezirk Anhembi, Fazenda Barrero Rico, Cerrado-Insel in einem Primärregenwald. 450 m. XI. 1979. K. Kalb & G. Plöbst. 31315# (KALB). - dto. 31588.

Remarks:

(1) *Acanthothecis caesiocarnea* differs from *A. hololeucoides* only by broader ascocarps with ± distinctly exposed disc. As the type specimen of *A. pachygraphoides* shows a large variability of this character even on one and the same thallus we do not consider it as specific enough for segregating two species.
(2) *Acanthothecis hololeucoides* corresponds in all character states with *A. pachygraphoides*. WIRTH & HALE (1963) indicate the type specimen in Helsinki as Isotype but it is inserted in Nylander's herbarium and the description written on the label (in Nylander's handwriting?) is exactly the same as in Nylander's publication. Therefore we consider it to be the holotype.
(3) The specimen marked with an asterisk (*)(KALB 30918) shows brownish (slightly carbonized?) edges of the margins and paraphysis-tips (like a brown collar below the warty head). We could not observe this in other specimens and we are not sure if it is a constant character. As there are no other differences according to the type we decided to list it here.
(4) The ascospores of the specimens marked with "#" (KALB 31338, 31315) are somewhat smaller than in the type (and the other specimens): 50–55 × 10–12 µm. All other characteristics correspond to the type.
(5) The type of *A. caesiocarnea* was too small for chemical investigations.

Acanthothecis incondita (Nyl.) Staiger & Kalb comb. nov.

≡ *Graphis incondita* Nyl., Bull. Soc. Linn. Normand. sér. 2,7: 176 (1874 [1873]).

Lectotype (MAKHIJA et al. 1992): Ins. Andaman, corticola, leg. Kurz 1867 No. 56. H-NYL 6841! (Stictic acid, constictic acid, fide annotation by Nakanishi 1972).

≡ *Graphina incondita* (Nyl.) Zahlbr., Cat. Lich. Univ. II: 409 (1923)

Thallus: Light-grey to yellowish, dull, uneven and with very small warts (due to crystals integrated in the pith), cortex rubbed off in parts.

Ascocarps: Oval to oblong (1–3 × 0.6–1 mm), rarely branched lirellae. Thalline margins ± raised from the thallus, paler than the thallus, little bulging. Disc ± open and distinctly white pruinose.

Excipulum: Uncarbonized, laterally striate, new hymenia develop below the old ones. The old hymenium is pushed to the side forming the lateral excipulum. Basal and lateral parts of the excipulum turn I+ slightly blue-violet.

Hymenium: Ca. 130–140 µm high.

Paraphyses: In this material without clearly visible warty tips. **Periphysoids** warty (at least in some periphysoids distinctly).

Ascospores: 8/ascus, hyaline, muriform, 10–11/3–5-celled, 30–37 × 12–14 µm, I-.

Chemistry: Stictic acid, constictic acid.

Specimens examined:

ASIA-TROPICAL

North Indian Ocean: Andaman Islands: See type specimen.

Remarks:

(1) The type is very fragmentary and therefore the morphological data are not very representative.
(2) *Graphina leucolyta* (Nyl.) Zahlbr. is very similar differing in smaller ascospores, a very distinct olive-green thallus and prominent, "furry" ascocarps. As we examined only the type specimens of these two species, it is difficult to judge the variability of the either. Examination of more material may prove them to be conspecific.

Acanthothecis intertexta (Müll. Arg.) Staiger & Kalb comb. nov.

≡ *Graphis intertexta* Müll. Arg., Bull. Herb. Boissier III (2): 45 (1895).

Holotype: U.S.A., Louisiana, Point à la Hache, on old fences. 1.2.1894, leg. Dr. Eckfeldt 231. G! [Norstictic acid, connorstictic acid, stictic acid (trace)].

Thallus: Light-brown to cream-coloured, dull, with deep cracks, "rugged".

Ascocarps: Concolorous with the thallus, closely neighboured, irregularly flexuose, rarely branched lirellae, 1–2 × 0.2 mm. Thalline margins not raised, disc concealed or ± exposed, whitish pruinose.

Excipulum: Uncarbonized, poorly developed at the base, thalline margin without striae.

Hymenium: Ca. 90 µm high, rounded to trapezium-like (broader below).

Paraphyses: With warty tips. **Periphysoids** warty as well, continuing at the sides of the excipulum as short hyphae without warty surface.

Ascospores: At least 6/ascus, hyaline, with transverse septa only, 11–17-celled, 30–45 × 5–7.5 µm, I-, spore locules cylindrical.

Chemistry: Norstictic acid, connorstictic acid, stictic acid (trace).

Specimen examined:

NORTHERN AMERICA

U.S.A.: Louisiana: See type specimen.

Remarks:

(1) Because we examined only the type specimen, the ascospore size is probably more variable than indicated here.
(2) HARRIS (1990) combined *Graphis intertexta* Müll. Arg. to the genus *Graphina* commenting that the type (Isotype in NY) only contains immature ascospores without longitudinal septa. Therefore we examined the holotype (in G) very carefully and checked a large number of ascospores - they all had transverse septa only as well. The spore locules are cylindrical (not lens shaped as in most *Graphis* species) and the interlocular plates do not turn

I+ blue-violet. However these ascospore characteristics are quite frequent in other *Acanthothecis* species, too (e. g. *A. clavuliferum*) and do not indicate that the spores are immature.
(3) Harris (1995) remarks that *Graphina intertexta* (Müll. Arg.) Harris is probably a synonym of *Graphina subvirginalis* (Nyl.) Müll. Arg. We have not seen the type of *Gr. subvirginalis* but the reported spore size (muriform, 60–85 × 13–17 µm) differs considerably from *Acanthothecis intertexta*.

Acanthothecis leucolyta (Nyl.) Staiger & Kalb comb. nov.

≡ *Graphis leucolyta* Nyl., Sertum Lichenaeae tropicae e Labuan et Singapore: 24 not., (1891).

≡ *Graphina leucolyta* (Nyl.) Zahlbr., Cat. Lich. Univ. II: 413 (1923).

Holotype: Lichenes Malaccenses in herb. Lojkano 11, Malacca, corticola, legit Scortechini. H-NYL 6819! (Stictic acid, constictic acid, fide annotation by Nakanishi 1973).

Thallus: Ochre to olive-green, dull, uneven.

Ascocarps: whitish, oval to oblong (1–3 × 0.6–1 mm), not branched (at least in the type). Thalline margins folded back, inside thick white pruinose, furry. Disc more or less open and white pruinose as well.

Excipulum: Uncarbonized, laterally striate, with substratum integrated, new hymenia can develop below the old ones. Parathecium (inner layer of the excipulum) I+ slightly blue. The margins that appear furry consist of crystals and hyphae. The hyphae at the surface are oblong and warty.

Hymenium: Ca. 100–110 µm high.

Paraphyses: Ca. 1 µm thick, anastomosing (above all laterally), not distinctly warty. **Periphysoids** ± distinctly warty (not always well developed).

Ascospores: 8/ascus, hyaline, muriform, 7–10/3-celled, 22–30 × 9–12 µm, I-.

Chemistry: Stictic acid, constictic acid (fide annotation label Nakanishi 1973).

Specimen examined:

ASIA-TROPICAL

Malesia: Malaya: **Peninsular Malaysia:** See type specimen (Malacca = Melaka).

Remarks:

(1) We have examined the type specimen only. *Graphina incondita* is quite similar (excipulum, paraphyses, chemistry) but differs in larger ascospores and less prominent furry ascocarps.
As we examined only the types of these species it is difficult to judge the variability of the either species. Examination of more material may prove them to be conspecific.

Acanthothecis leucoxantha (Müll. Arg.) Staiger & Kalb comb. nov.

≡ *Graphis leucoxantha* Müll. Arg., Flora 63: 21 (1880).

Holoype: Brazil, Apiahy, 1879, Puiggari s.n. G! (Stictic acid, peristictic acid).

Fig.: 23.

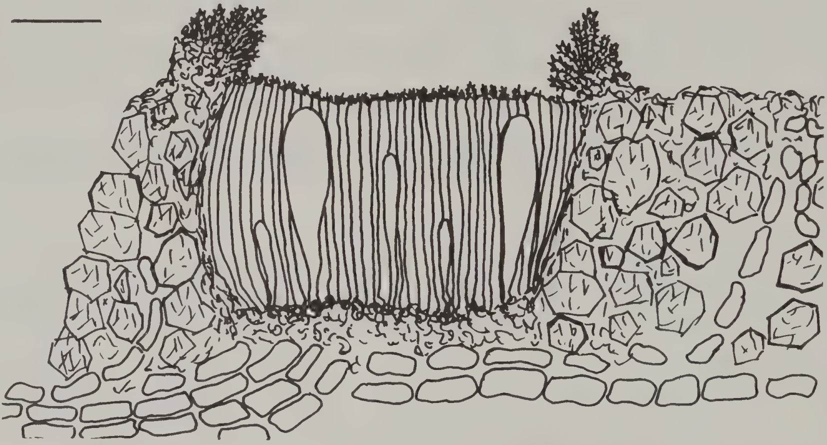


Fig. 23

Fig. 23: *Acanthothecis leucoxantha* [KALB 31311]; bar = 40 µm

Thallus: Thin, light grey to yellowish, dull, many crystals are integrated.

Ascocarps: oval to oblong (1–2 × 0.5–0.8 mm), rarely branched. Margins paler than the thallus, crenate, well developed, mealy-granular.

Excipulum: Uncarbonized, not well developed, yellowish at the base, Ca-oxalate crystals are integrated at the side.

Hymenium: 50–70 µm high.

Paraphyses: Tips distinctly warty. **Periphysoids** warty as well, mainly at the tips (ca. 10–15 µm). They continue (with smooth surface) beneath the hymenium.

Ascospores: At least 4/ascus, hyaline, with transverse septa only, 6–10-celled, 20–30 × 5–6 µm. The interlocular plates turn I+ light-blue.

Chemistry: Stictic acid, peristictic acid.

Specimens examined:

SOUTH AMERICA

Brazil: São Paulo: Apiahi (=Apiaí) see type specimen. - Bei der Stadt Cotia, etwa 30 km

E von São Paulo, auf dem Sitio von Sr. Gunter. 950 m. XII. 1978. K. Kalb & L. Assis 31311 (KALB).

Remarks:

(1) MÜLLER. ARG. (1880) indicates in his description: Spores 6–7-celled, 14–18 × 4–5 µm. We could find only very few ascospores in the type specimen but they were all larger (9-celled, 24–26 × 6 µm).

Acanthothecis mirabilis Staiger & Kalb spec. nov.

Thallus corticolus, tenuis, albidus vel cremeus. Ascocarpia rotundata vel leviter oblongata (0.5–1 × 0.3–0.6 mm), disco et margine cinnabarinis vel brunneo-cinnabarinis. Excipulum non carbonisatum sed cristallis cinnabarinis instructum. – Hymenium ca. 60–90 µm altum, in parte superiore cristallis cinnabarinis instructum. Paraphyses ca. 1,5 µm crassae, apicibus brunneis et incrassatis et verrucosis. Periphysoides ca. 30 µm longae, distincte verrucosae. Ascosporae octonae, hyalinae, cum 9–12 septis transversalibus, 22–31 × 4–6 µm, I+ violaceae.

Holotype: Brazil, Minas Gerais, Serra do Espinhaço: Serra do Caraça; Bocaina, etwa 4 km E des Klosters 1450 m. leg. K. Kalb & G. Plöbst. 11.7.1978 (KALB 31313 – hb. K. Kalb, Holotypus). (Isohypocrelline = red pigment).

Fig.: 24 and 25.

Thallus: Very thin (depending on the substratum), whitish to cream-coloured.

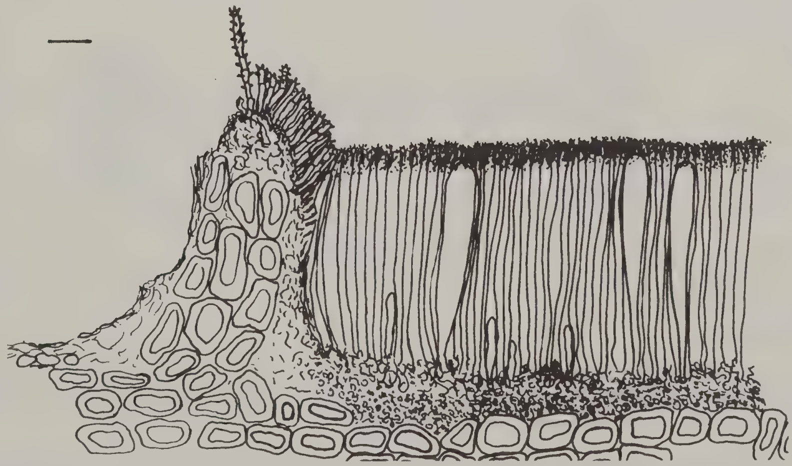


Fig. 24

Fig. 24: *Acanthothecis mirabilis* [KALB 31313], section through young ascocarp; bar = 20 µm

Ascocarps: round or oval, rarely ± oblong (0.5–1 × 0.3–0.6 mm), conspicuous dark red (carmine) lirellae. The margins are deep red and may be distinctly crenate to flaky. Disc exposed, brownish-red.

Excipulum: Uncarbonized, however red pigment-granules are integrated all over the excipulum. Bark cells are in the lateral part of the excipulum/margins up to the edge. New hymenia can develop below the old ones pushing the old hymenium at the side and building the flaky margins.

Hymenium: Ca. 60–90 µm high, especially the upper part with small red granules.

Paraphyses: Ca. 1.5 µm thick, tips brownish, thickened and warty. **Periphysoids** up to 30 µm long, distinctly warty, growing out of the inner side and the edge of the margins, continuing beneath the hymenium.

Ascospores: 8/ascus, hyaline, with transverse septa only, 10–13-celled, 22–31 × 4–6 µm, I+ violet. The spore locules are lens-shaped.

Chemistry: Isohypocrelline (red pigment, MATHEY et al. 1994). After adding K to a section, the red granules dissolve with green colour.

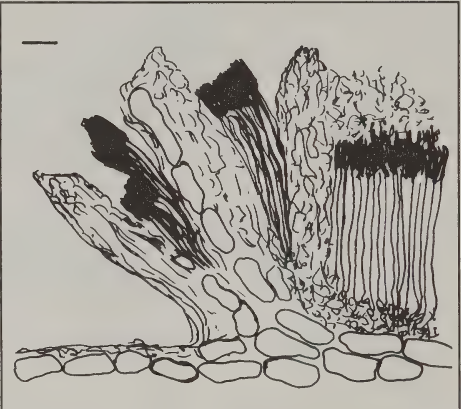


Fig. 25

Fig. 25: *Acanthothecis mirabilis* [KALB 31313]; section through excipulum of an old ascocarp; bar = 20 µm

Specimens examined:

SOUTH AMERICA

Brazil: Minas Gerais: Serra do Espinhaço, Serra do Caraça, Bocaina, etwa 4 km E des Klosters. 1450 m. VII. 1978. K. Kalb & G. Plöbst 31344 (KALB), dto. 31312 [b] growing together with *A. obscura*.

Remarks:

(1) We compared the specimens of *A. mirabilis* with the types of most so far known species with red ascocarps. Types of the following red-fruited species with similar characters have been checked:

Graphina haemographa (Nyl.) Müll. Arg., *Graphis buritica* Redinger, *Graphis haemolobata* Redinger, *Graphis rhodastra* Redinger, *Phaeographis cinnabarina* (Fée) Müll. Arg. and *Phaeographis haematites* (Fée) Müll. Arg.

None of them corresponds to the specimens listed above.

Acanthothecis obscura Staiger & Kalb spec. nov.

Thallus corticolus, pallide cinereus, opacus. Ascocarpia rotundata vel leviter oblongata (1–1.5 mm in diametro), disco griseo-brunneo, leviter albide pruinoso. Excipulum non bene evolutum, carbonisatum, imprimis lateraliter et marginaliter. – Hymenium ca. 100–110 µm altum, dense oleose inspersum. Paraphyses apicibus brunneis et leviter incrassatis et verrucosis. Periphysoides brunneolae, verrucosae. Ascosporae 6–8, murales, hyalinae cum 11–13 septis transversalibus et 2–3 septis longitudinalibus, 35–50 × 9–12 µm, I-.

Holotype: Brazil, Minas Gerais, Serra do Espinhaço: Serra do Caraça; Bocaina, etwa 4 km E des Klosters; 1450 m. 11.7.1978 K. Kalb & G. Plöbst. (KALB 31343 – hb. K. Kalb, Holotypus). (no substances present - TLC).

Fig.: 16 and 26.

Thallus: Thin (probably due to the growth of the substratum), light-grey, dull.

Ascocarps: Rounded or oval, ca. 1–1.5 mm diam. Thalline margins reflexed, proper exciple brownish black. Disc exposed, grey brownish, weakly white pruinose.

Excipulum: Weakly carbonized at the base, not well developed. Mainly the lateral excipulum and overall the edges of the margins are distinctly carbonized (they are raised over the hymenium and form the brown-black proper exciple).

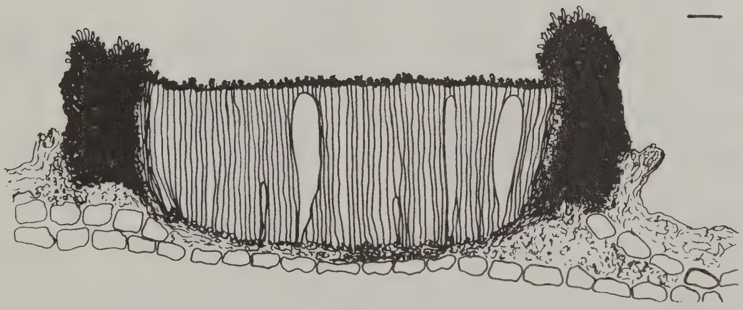


Fig. 26

Fig. 26: *Acanthothecis obscura* [KALB 31343]; bar = 20 µm

Hymenium 100-110 µm high, distinctly inspersed with oil droplets.

Paraphyses: Tips brownish and slightly thickened; warty. **Periphysoids** develop from the lateral, carbonized part of the margins and have a continuation beneath the hymenium. They are brownish with exception of the hyaline tips and only some show a distinct warty surface.

Ascospores: 6–8/ascus, hyaline, muriform, slightly tailed, 12–14/3–4-celled, 35–50 × 9–12 µm, I-.

Chemistry: Nil (TLC).

Specimens examined:

SOUTH AMERICA

Brazil: **Minas Gerais:** Serra do Espinhaço, Serra do Caraça, Bocaina, etwa 4 km E des Klosters. 1450 m. VII. 1978. K. Kalb & G. Plöbst 31312 [a] (KALB). - dto. 31345 [b] (KALB).

Remarks:

(1) This species differs in some character states from other *Acanthothecis* species:

- The inner margin is distinctly brownish/carbonized, the excipulum is carbonized.
- The periphysoids and the tips of the paraphyses are brownish.
- The hymenium is inspersed.

Nevertheless we decided to include it in the genus *Acanthothecis* for the following reasons:

- In *Acanthothecis hololeucoides* one specimen shows slightly brownish margins; in *A. tetraphora* and *A. mirabilis* brownish periphysoids and paraphysis-tips occur, too. Therefore a transition from species with slightly carbonized to distinctly carbonized margins can be traced.
- Species with inspersed and not inspersed hymenia occur in closely related *Graphis* species, too. Therefore this character was not considered to be important in respect of the generic classification.

Acanthothecis sanguinoloba (Redinger) Staiger & Kalb comb. nov.

≡ *Graphis sanguinoloba* Redinger, Ark. Bot. 27 A (3): 60 (1935).

Holotype: Brazil, Matto Grosso, Cuyabá, in silvula ripae rivuli, 30.12.1893, leg. G. A. Malme Nr. 2203. S! (Isohypocrelline, unknown 38/40/38 - TLC).
Fig.: 27 and 28.
Thallus: Yellowish to light ochre, smooth to slightly uneven, containing only few algae, cortex well developed, ca. 50 µm thick.
Ascocarps: Oval or slightly oblong (1–2 x 0,5–1 mm), unbranched, ± curved, conspicuously dark red coloured (like *A. mirabilis*). The margin is divided into a thin ± reflexed outer thalline margin, and an inner, red coloured margin that is inclined to the center, covering the disc. A red powdery mass is filling the gap between these two parts of the margin.
Excipulum: Uncarbonized, not well developed at the base. Bark cells are integrated laterally, and the margins are distinctly inclined to the cenral part of the ascocarp (REDINGER 1935 writes in the protologue: with an angel of 45°). Red pigment-granules and several Ca-oxalate crystals are located between the outer thalline margin and the inner, inclined margin. The parathecium turns I+ blue.

Hymenium: 80-100 µm high with remarcable many asci.

Paraphyses: Ca. 1-1,5 µm thick, tips, hyaline, warty. **Periphysoids** short (5-10 µm long), warty; they develop from the inner margin (like in *A. hololeucoides*).

Spores: 8/ascus, hyaline, sometimes pale brown and ± degenerated, with transverse septa only, 4-celled, 17–20 × 6-8 µm, with a thin (ca. 0,5 µm) gelatinous layer, I+ violet. The spore locules are rounded (fig.:28).

Chemistry: Isohypocrelline, unknown (39/40/38).

Specimen examined:

SOUTH AMERICA

BRAZIL: Mato Grosso: See type specimen.

Remarks:

(1) REDINGER (1935) indicates in the protologue that the red pigment does not react by adding K. However we could observe the same reaction as in *A. mirabilis*: After adding K to a section, the red pigment-granula dissolve and a green coloured solution is floating out.

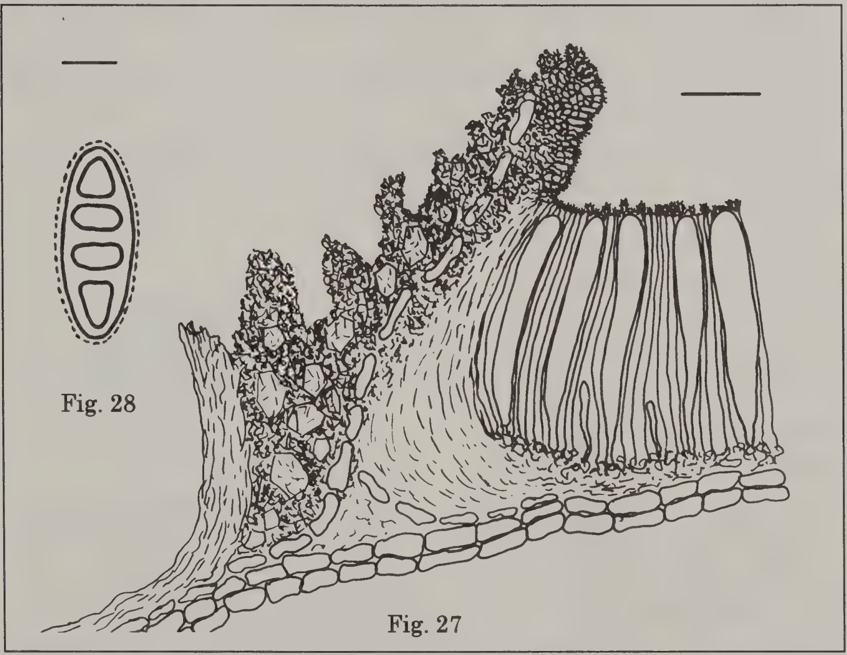


Fig. 28

Fig. 27

Fig. 27 - 28: *Acanthothecis sanguinoloba* (fig. 27); bar = 30 µm, spore (fig. 28); bar = 5 µm

Acanthothecis cf. *silicicola* (Redinger) Staiger & Kalb

Acanthothecis silicicola (Redinger) Staiger & Kalb **comb. nov.**

≡ *Graphis silicicola* Redinger, Ark. Bot. 27 A (3): 56 (1935).

Holotype: Paraguay, Paraguari, Cerro Negro, pr. summum montem (loco umbroso) ad saxa gneissaceae, 1.8.1893, leg.: G. A. Malme nr. 1487. S.

Thallus: On sandstone or gneiss, cream-coloured to light-beige, fine-fissured, areolate, surface with small, mealy warts.

Ascocarps: Short (1–1.5 × 0.5 mm), mostly unbranched lirellae, concolourous with the thallus. Margins slightly raised from the thallus, slightly crenate, darker along the slit. Disc ± opened, flesh-coloured, whitish pruinose.

Excipulum: Uncarbonized, well developed at the base and lateral. New hymenia can develop below the old ones and push them aside. The lateral excipulum is striate due to the alternating layers of old hymenia and old margins.

Hymenium: 80–90 µm high, the subhymenium contains inspersed large oil droplets.

Paraphyses: Tips not warty. **Periphysoids** not distinctly developed with very rare and indistinct warts.

Ascospores: 8/ascus, hyaline, with transverse septa only, 6-celled, 19–22 × 6 µm, I-, spore locules rounded (not distinctly cylindrical and not distinctly lens-shaped).

Chemistry: Norstictic acid , connorstictic acid.

Specimens examined:

SOUTH AMERICA

Brazil: Mato Grosso: Chapada dos Guimarães, Umgebung von Buriti, in relativ feuchtem Cerrado bzw. an ± freistehenden Sandsteinfelsen. 850 m. 15°30' S; 55°40'W. 1993 K. & A. Kalb 27823 (KALB).

Paraguay: See type specimen.

Remarks:

(1) Although this species does not show warty paraphysis-tips and periphysoids, it shares all the other important characters with the type species of the genus, especially the non-carbonized excipulum, the I- ascospores and the production of new hymenia below the old ones resulting in striate margins of the ascocarp. Futhermore, the chemistry and the overall habitus are identical to other *Acanthothecis* species (e. g. *A. intertexta*), which makes us fully convinced that we have assigned the correct genus to this species.

Acanthothecis tetraphora (Nyl.) Staiger & Kalb comb. nov.

≡ *Graphis tetraphora* Nyl., Ann. Sci. Nat., sér. 4 (Bot.), 20: 265. (1863).

Isotype: Nova Granata, Tequendama, Canoas, altit. 2600 m, ad corticem arboris. Sept. 1860. Lindig s. n. H-NYL p. m. (Post mortem Nylandri insertum) 6124 ! (Norstictic acid, lichexanthone).

≡ *Graphina tetraphora* (Nyl.) Zahlbr., Cat. Lich. Univ. II: 429 (1923).

Fig.: 29, 30 and 31.

Thallus: White to grey, yellowish, thin, mealy powdery, appearing almost grey, sorediate.

Ascocarps: Flexuose, branched, oval to oblong lirellae 1–3 × 0.5–0.8 mm. Thalline margin cream-coloured, paler than the thallus, slightly bulging. Disc open, whitish, pruinose.

Excipulum: Uncarbonized, laterally often with integrated substratum. The margins are partly brownish. The periphysoids arise from the upper side of the margins.

Hymenium: Ca. 120–170 µm high.

Ascospores: 4-6/ascus, hyaline, muriform, 20–30/3–4-celled, 65–95 × 13–18 µm, I-.

Paraphyses: Ca. 1 µm thick. The tips have short segments and are thickened (up to 3 µm). They jut 10–20 µm over the hymenium and have distinctly warty heads. Not all paraphyses show these tips, as they probably break easily. The **periphysoids** grow at the upper side of the margins and reach more than 50 µm in length. They consist of several segments and have distinct warts over the whole length. The basal part of the periphysoids can be thick-walled and brownish.

Chemistry: Norstictic acid, connorstictic acid, lichexanthone.

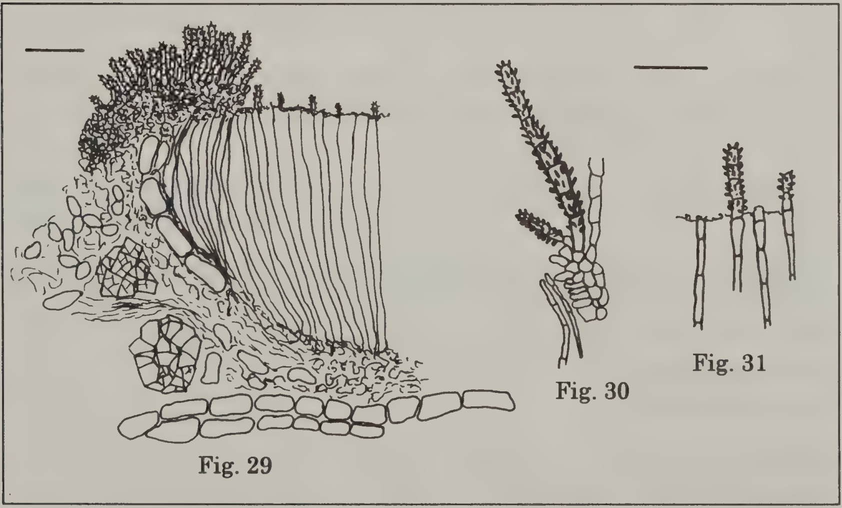


Fig. 29

Fig. 30

Fig. 31

Fig. 29 - 31: *Acanthothecis tetraphora* [H-NYL. 6124]; section through excipulum and part of hymenium (fig. 29); bar = 40 µm, periphysoids (fig. 30); and paraphyses, jutting over the hymenium (fig. 31); bar = 20 µm

Specimens examined:

SOUTH AMERICA

Colombia: See type specimen.

Brazil: São Paulo: Serra da Mantiqueira, Pico da Itapeva, oberhalb von Campos do Jordão, in einem feuchten, schattigen Bergwald. X. 1978. K. Kalb & G. Plöbst 31335 (KALB).

Remarks:

(1) *Acanthothecis tetraphora* differs from *A. hololeucoides* in the chemistry and the position and length of the periphysoids. The periphysoids seem to develop at the outer side and not the inner side of the margin like in *A. hololeucoides*. This would mean that they are generated in a quite different way. Another possible explanation is that the young margins are folded back or break and the periphysoids develop at the edge of the former margin. Unfortunately it was not possible to examine the development of the young ascocarp and the periphysoids in this species.
(2) The type specimen mentioned above was inserted in Nylander's herbarium after his death (post mortem) and is probably an isotype. In the Nylander Herbarium in Helsinki (H-NYL) no other type material of this species could be found.

Acanthothecis bicellulata ad int.

Thallus: Thin (ca. 30 µm), light-grey, irregularly.

Ascocarps: Round or oval (0.8 × 0.3 mm), thalline margins seem to develop from the former cover of the hymenium. The disc is open and white pruinose.

Excipulum: Uncarbonized, but laterally and at the margins at least sometimes with brownish hyphae. Poorly developed at the base.

Hymenium: 40–60 µm high.

Paraphyses: Tips thickened, distinctly warty. **Periphysoids** develop from the inner side of the margins and are distinctly warty and often thickened at the tips.

Ascospores: 8/ascus, hyaline, two-celled, spindle-shaped with ± tapering ends, 7–10 × 3–4 µm, with halo or gelatinous layer (1 µm), I-.

Chemistry: The sample was too small for chemical investigations.

Specimen examined:

SOUTH AMERICA

Brazil: Minas Gerais: Serra do Espinhaço, Serra do Caraça, Bocaina, etwa 4 km E des Klosters. 1450 m. VII. 1978. K. Kalb & G. Plöbst 31345 [a] (KALB).

Remarks:

(1) It was not possible to determine this species with the current keys, including those for Thelotremataceae (HALE 1974 1978, 1981).

Acanthothecis farinosa ad int.

Thallus: Light-grey to greenish, cortex lacking. Therefore with powdery surface; many fissures.

Ascocarps: Irregularly flexuous lirellae (1–2 mm), ± branched, resembling fissures with thalline margins, disc slit-like or ± open, white pruinose.

Excipulum: Uncarbonized, yellowish, well developed. New hymenia can develop below the old ones. The parathecium (the inner layer of the excipulum) turns I+ blue.

Hymenium: Ca. 80 µm high.

Paraphyses: 1.5–2 µm thick, unbranched, tips not thickened and without warts. The **periphysoids** grow out of the thalline margin. They are distinctly warty and ca. 20 µm long.

Ascospores: 8/ascus, hyaline, with transverse septa only, 6–9-celled, 20–25 × 5–7 µm, I+ faint blue, spore locules lens-shaped.

Chemistry: Norstictic acid, connorstictic acid

Specimens examined:

SOUTH AMERICA

Brazil: Brazil North: **Amazonas:** Im Überschwemmungsbereich des Rio Preto, kurz vor der Mündung in den Amazonas, ca. 80 km E von Manaus. 40 m. 03°10'S; 59°50'W. VIII. 1993 K. & A. Kalb 27792 (KALB). - dto. 27086 (KALB).

Remarks:

(1) This species differs from *A. gracilis* in the I+ faintly blue reaction of the ascospores and the lack of longitudinal septa.

Acanthothecis subabaphoides ad int.

The specimens listed here correspond in all characteristics with *A. abaphoides* except:

Thallus: UV+ yellow.

Excipulum: The lateral striae turn I+ blue.

Ascospores: 4–6/ascus, hyaline, with transverse septa only, 20–28-celled, 65–85 × 9–11 µm, no thickening of the spore wall, spore locules cylindrical to slightly rounded, I-.

Chemistry: Protocetraric acid, lichexanthone.

Specimens examined:

SOUTH AMERICA

Brazil: Mato Grosso: Zwischen Jaciara und São Vincente, etwa 100 km ESE von Cuiaba, in einem Cerrado. 750 m. V.1980. K. Kalb. 28850 (KALB). - dto. 31320 [a] (KALB).

Remarks:

(1) This species is quite similar to *Acanthothecis clavulifera* but differs in the presence of internal striae of the lateral excipulum and the I+ blue reac-

tion of parathecium and striae. (Probably the ascocarp development differs in the same way as *A. abaphoides* diffes from *A. hololeucoides*). In addition the occurrence of lichexanthone makes it easy to distinguish *A. subabaphoides* from *A. abaphoides*.

(2) We were not able to determine this species with the current literature. *Graphis glaucopis* Wirth & Hale (WIRTH & HALE 1963: p 94) seems to be quite similar. But they indicate: "Thallus extremely thick, K+ orange, P-; ascocarps P+ red, K+ orange; spores very variable in size: 75-260 µm and heavy walled."

The description of *Graphis implicata* Fée (according to WIRTH & HALE 1963: p 96) also resembles this species (concerning excipulum and ascospore size) but they indicate norstictic acid as chemical compound.

As the material is scarce and several other names should be checked we have not described it as a new species.

3.6.2. *Fissurina* Fée

FÉE, A. L. A. Méthode lichénographique et genera: XXXV (1824).

Lectotype of the genus (designated here): *Fissurina dumastii* Fée.

Holotype: Habitat in America, ad corticem *Cinchonae lancifoliae*. G!

Fig.: 6.

Phycobiont: *Trentepohlia.*

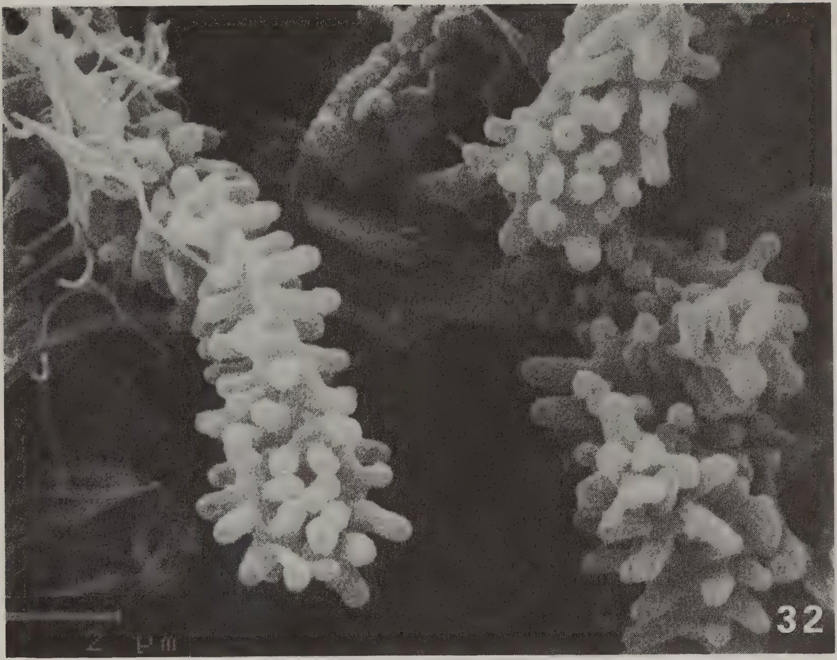
Thallus: Usually smooth, glossy, cream-coloured or ochre to olive-green. Cortex mostly well developed, prosoplectenchymatous with periclinal hyphae. Often a layer of Ca-oxalate-crystals can be found in the medullary layer.

Ascocarps: Fissurine, i. e. originating as a crack, the disc usually concealed by the narrow to gaping fissure walls. The margins are formed by the thallus, and can fold back to more or less expose the disc and the inner part of the margin and show well the hemiangiocarp development of the lirellae. They often seem to be pruinose due to short periphysoids (with or without warty surface) and paraphyses that jut out of the hymenium. Some species show the tendency of slightly bulging margins due to crystals in the margin-tips.

Excipulum: Not carbonized, often poorly developed, sometimes consisting of yellowish hyphae. Sections of the ascocarp (particularly young parts) show a trapezium-like or triangle hymenium (in cross section!). The "corners" of the excipulum (fig. 6 - arrow) seem to be the growth zone of the hymenium and often react I+ light-blue.

Hymenium: Trapezium or triangle-like in cross section (broader below), not inspersed, I-, 60–100 µm high.

Fig. 32 - 33: Paraphysis-tips of *Fissurina dumastii* [KALB 31356] (fig. 32) and *Chroodiscus brasilianus* [KALB 31348] (fig. 33).



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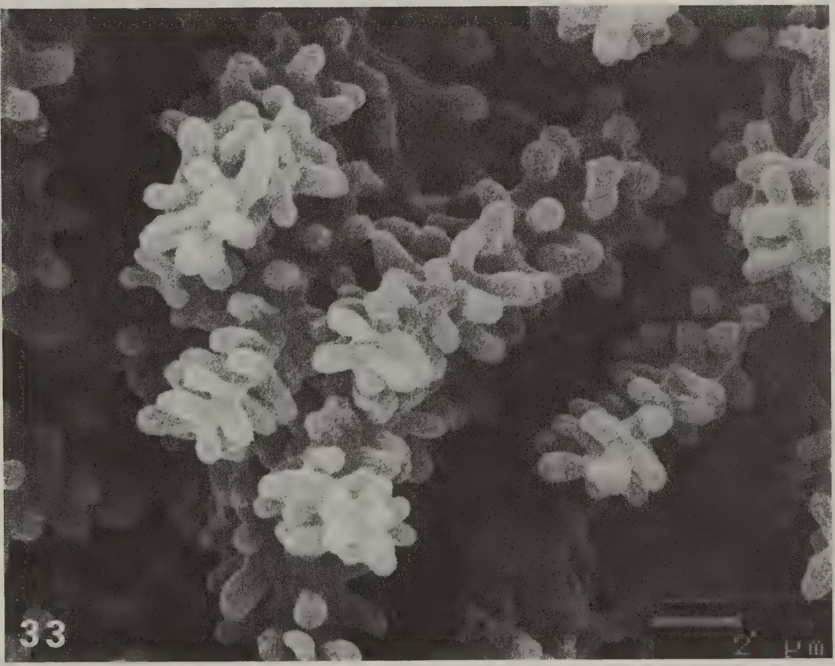

33

Paraphyses: Parallel, not connected, little branched or unbranched, hyaline (the tips can be slightly brown (*Fissurina incrustans* Fée). In some species the tips are ± distinctly warty and jut out of the hymenium.

Periphysoids: Some species form periphysoids at the inside of the thalline margins. These lateral paraphyses can be warty (see species above).

Ascus: 4–8-spored, „*Graphis*-type“.

Ascospores: Hyaline, rounded, thick-walled, often with halo or jelly-like outer layer, that can be slipped off, muriform or with transverse septa, spore locules round or lens-shaped, often arranged irregularly. Reaction with I: I+ violet, I+ light-blue or greyish, I- (fig. 11).

Pycnidia: Not seen.

Remarks:

(1) In the generic description of *Fissurina* FÉE (1824) lists three species: *Fissurina dumastii*, *F. incrustans* and *F. lactea*. The last-mentioned was provided with a question mark and therefore was ruled out as lectotype for the genus. The two remaining species are certainly congeneric and show the unnatural system of spore genera. WIRTH & HALE (1978) indicate them as "sporomorphs": Species that are extremely similar (or identical) in external morphology, anatomy, chemistry and ascospore size but that are presently placed in different genera because of spore septation and/or colour only - *Fissurina dumastii* has only transversely septate ascospores and was placed in *Graphis*, *Fissurina incrustans* has muriform ascospores and was placed in *Graphina*.

(2) At present in "Outline of the ascomycetes — 1998" (ERIKSSON & HAWKSWORTH 1998) the genus *Fissurina* is listed as synonym to *Graphis* following the system of spore genera by MÜLLER ARG. (1880, 1882) that was adopted by ZAHLBRUCKNER (1923, 1926). The name *Fissurina* was used only for generic sections (REDINGER 1935, ZAHLBRUCKNER 1923) or subgenera (VAINIO 1921). With the description of the new species *Fissurina quadrispora* KALB & HAFELLNER (1992) the name *Fissurina* was resurrected at the generic level. Although Aptroot and Sipman (HAWKSWORTH 1997: 395) remark that *Fissurina* differs distinctly from *Graphis* they did not want to draw systematical conclusions at this time.

But *Fissurina* shares only few characteristics with the genus *Graphis* (not in the sense of Müller Arg. but referring to the generic type, *Graphis scripta*). The most obvious differences are:

- Carbonized excipulum in *Graphis* versus uncarbonized excipulum in *Fissurina*.
- Ovoid ascospores with halo (at least in most species) in *Fissurina* versus oblong ± thin-walled ascospores in *Graphis*.
- Fissurine ascocarp with thalline margin in *Fissurina* versus distinctly carbonized margins (and excipulum) with or without thalline cover in *Graphis*.

Therefore we consider it as justified to reintroduce the genus *Fissurina* and hope that it will be a further step towards a more natural system in the family Graphidaceae. We want to give a more detailed discussion of the differentiation of *Fissurina* versus other genera in a later paper.

Species:

Fissurina dumastii Fée

Fée, A. L. A. Essai crypt. écorces exot. officin.: 59 (1825).

Holotype: Habitat in America, ad corticem *Cinchonae lancifoliae*. G! (Unknowns, annotation label by Kalb 1992).

Thallus: Olive- to yellow-green, smooth, slightly glossy, cortex well developed.

Ascocarp: Oblong, up to 5 mm long and 0.2–0.3 mm broad, branched, concolorous with the thallus. Lirellae fissurine, thalline margins gaping and exposing the disc. Inner sides of the margins and disc slightly white-pruinose.

Excipulum: Uncarbonized, poorly developed at the base, yellowish. The outer part of the margin consists of a thalline layer containing algae and in the inner part several large Ca-oxalate crystals may be embedded.

Hymenium: 80–100 µm.

Paraphyses: Hyaline, with slightly thickened, ± warty tips (fig. 30). **Periphysoids** short with ± distinctly warty tips.

Ascospores: 8/ascus, hyaline, 4-celled, 11–16 × 5–6 µm, with 1–3 µm halo, I- or light blue.

Chemistry: Nil or unknown substance, orange coloured after treatment with 10% H_2SO_4, R_f-values (53-58/26/49 solvent systems A, B', C).

Specimens examined:

SOUTH AMERICA

Brazil: Mato Grosso: Zwischen São Vicente und Aquas Quentes, etwa 90 km ESE von Cuiaba. In einem dichten Galerie-Wald. 650 m. VII. 1980. K. Kalb 31069# (KALB). - **São Paulo:** Ilha Comprida gegenüber von Cananeia; in einem sehr feuchten Stranddünenwald (Restinga). 3 m. VII. 1979. K. Kalb 31303 (KALB). - dto. 31309 (KALB). - dto. 31249 (KALB). - Ilha Comprida gegenüber von Cananeia; in einem trockenen Stranddünenwald (Restinga). 2 m. III. 1979. K. Kalb & G. Plöbst 20454 (KALB). - Serra do Mar, Serra do Peruibe, bei Ana Dias. 120 km SW von São Paulo, in einem hellen, sehr feuchten Urwald. 50 m. IV. 1978. K. Kalb und G. Plöbst 31356 (KALB). - Praia Grande S von São Paulo; in einer Mangrove. 2 m. XII. 1978. K. Kalb & D. Hannack 25177* (KALB). - dto. 31357* (KALB).

Remarks:

(1) The presence of warty periphysoids seems to be no constant character in this species and probably in other species of the genus as well. It seems to depend on the age of the ascocarp whether it can be observed or not. Often a whitish pruina-like surface at the inside of the margins indicates that this part of the ascocarp shows warty periphysoids. It is not clear which other

factors could have an influence on the formation of the warty surface.
(2) In almost all species listed here the unknown substance with the R_f-values (53-58/26/40) is present. In the specimen indicated "#" it could not be detected with TLC.
(3) In the specimens indicated "*" no warty periphysoids could be found.

Fissurina instabilis (Nyl.) Nyl.

NYLANDER, W. Sertum Lichenaeae tropicae e Labuan et Singapore: 36 (1891).

≡ *Graphis instabilis* Nyl., Ann. Sci. Nat., sér. 4 (Bot.), 19: 371 (1863).

Holotype: Bonin Islands near Japan (ex herb. Tuck.). H-NYL 6834! (Nil, annotation Nakanishi 1973).

≡ *Graphina instabilis* (Nyl.) Zahlbr., Cat. Lich. Univ. II: 410 (1923).

Thallus: Ochre to olive-green, smooth, slightly warty, cortex well developed, prosoplectenchymatous.

Ascocarps: Short to oblong, irregularly or star like branched lirellae. Disc concealed in ± opened thallus-cracks. Disc and inside of the thalline margin white pruinose.

Excipulum: Not carbonized, poorly developed at the base. Lateral thalline margins (containing algae) just over the hymenium.

Hymenium: Ca. 100 µm high.

Paraphyses: Slightly anastomosing, with ± clavate tips (± warty). **Periphysoids** growing out of the inside and the edge of the margin, several segments of the hyphae can be distinctly warty. Unfortunately in the type no warts could be observed.

Ascospores: 8/ascus, hyaline, muriform, 5–6/2–3-celled, 21–25 × 11–14 µm + 2-3 µm halo, I+ violet.

Chemistry: Unknown fatty acid, R_f-values (7/2/1) (solvent systems A, B', C).

Specimens examined:

SOUTH AMERICA

Brazil: São Paulo: Bezirk Anhembi, Fazenda Barrero Rico, in einem dunklen, feuchten Primärregenwald. 450 m. XI. 1979. K. Kalb 28815 (KALB).

Remarks:

(1) The type is very fragmentary and we therefore hesitated to make further chemical investigations. The presence of fatty acids is sometimes difficult to observe and may have been overlooked by Nakanishi.
(2) We could not observe distinct warty periphysoids or paraphysis-tips in the type specimen. For discussion see remark (1) in the description of *Fissurina dumastii*.

3.6.3. Species with warty periphysoids and carbonized excipulum ”carbonized group”

The species listed below form a homogenous, probably natural group corresponding in many characteristics:

The excipulum is cupular (in cross section!), carbonized and the margins form a distinct, deep slit.

The ascocarps are covered by a thalline layer. Near the slit the periphysoids grow out of the carbonized excipulum and give the area around the slit a white-mealy appearance.

Only the periphysoids are warty; the paraphyses are thin and have no thickened, warty tips.

Probably several species without warty periphysoids belong to this group, too. We will treat this group in a forthcoming paper more thoroughly.

Graphina amicta (Nyl.) Zahlbr.

ZAHLBRUCKNER, A. Cat. Lich. Univ. II: 394 (1923).

≡ *Graphis amicta* Nyl., Ann. Sci. Nat., sér.4 (Bot.), 19: 370 not. (1863).

Holotype: Japonia, Bonin Islands, E. J. Gr.4. H-NYL 7525! (Salazinic acid, fide annotation by Nakanishi 1973).

Thallus: Cream-coloured to light-brown, with dull, slightly warty surface.

Ascocarps: Oblong, 3 × 0.25 mm, ± flexuose lirellae with white (sometimes orange), granular thalline cover. Disc slit-like.

Excipulum: Carbonized, the carbonization is laterally spreading to the substrate; the base is only poorly carbonized. The carbonized margins are totally covered by a thalline layer.

Paraphyses: Tips not warty. **Periphysoids** develop from carbonized excipular hyphae and cover the inside of the slit. They are hyaline and the tips are warty.

Ascospores: 8/ascus, hyaline, submuriform, 6–7/2–3-celled, 14–18 × 6–7 µm, I+ red-violet, the outer spore wall is stained only weakly.

Chemistry: Salazinic acid.

Specimens examined:

Northwestern Pacific: Ogasawara-shoto: Bonin Islands: See type specimen.

Remarks:

(1) *Graphina amicta* differs from *Graphina marcescens* only in larger ascospores that turn I+ red-violet and a more distinctly carbonized excipulum. Other characteristics correspond and the examination of more material could probably reveal, that they are conspecific. WIRTH & HALE (1978) remark in the description of *Graphina marcescens* that they have seen a specimen from India ”which differs from the neotropical material only in being somewhat larger and in having the excipulum base a bit more carbonized”.

Graphina marcescens (Fée) Müll. Arg.

MÜLLER ARG., J. Mém. Soc. Phys. et Hist. Nat. Genève 29(8): 42 (1887).

≡ *Graphis marcescens* Fée, Essai sur les cryptogames des écorces exotiques officinales: 38, tab. XV fig. 2 (1825).

Lectotype (WIRTH & HALE 1978)**:** Habitat in America meridionali, ad corticem *Bonplandiae trifoliatae* (Humb. et Bonpl.) (Angusturae verae officinarum). G!.

Isolectotype: M! (Salazinic acid).

= *Graphis intricata* Eschw. in Martius (non *Graphis intricata* Fée 1825: 42). Flora Brasiliensis seu enumeratio plantarum in Brasilia tam sua sponte quam accedente cultura provenientum I (1): 79 (1833).

Lectotype (WIRTH & HALE 1978)**:** Brazil, Martius s.n. (M) not seen.

= *Graphina plittii* Zahlbr., Annal. Naturhist. Mus. Wien, 42: 60 (1928).

Lectotype (WIRTH & HALE 1978): America borealis (U. S., Florida): Prope Miami, corticola, leg. C. C. Plitt. Kryptogamae exsiccatae a Mus. Hist. Nat. Vindobon. No. 3051. W.

Isolectotype: M! (Salazinic acid, protocetraric acid - trace).

Fig.: 34.

Thallus: Yellow-grey or greenish-grey, dull, uneven or slightly warty.

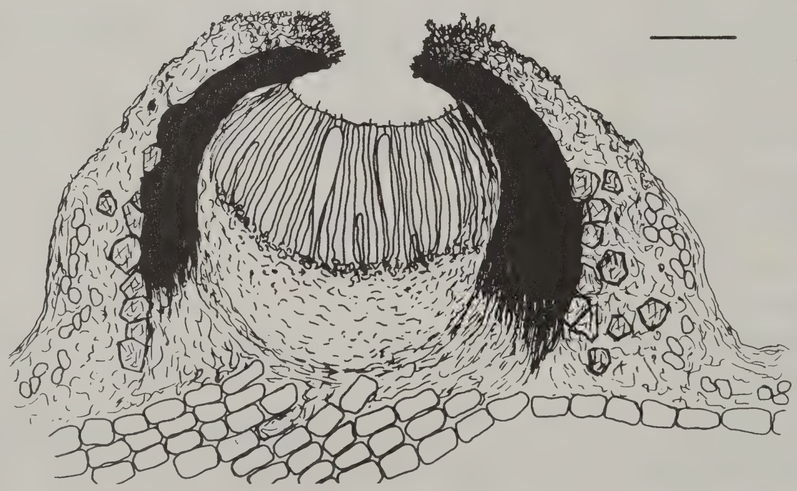

Fig. 34

Fig. 34: *Graphina marcescens* [Sipman & Aptroot 19004]; bar = 30 µm

Ascocarps: ± oblong, branched lirellae, distinctly raised from the thallus. The carbonized margins are covered with a white, mealy tissue that can be rubbed away easily. The disc is concealed by the margins.

Excipulum: Distinctly carbonized above (at the edges of the margins) and laterally. At the base the excipulum is well developed but not carbonized, consisting of yellow to reddish hyphae. The lower part of the excipulum is concealed in the thallus whereas the upper, carbonized part is raised above the thallus. The hyaline periphysoids grow out of the carbonized edge of the excipulum.

Hymenium: 50–60 µm high.

Paraphyses: Thin, tips without warts. The **periphysoids** develop from the carbonized plectenchyma of the excipulum and loom partly inside the slit and partly to the outer side of the margin. Mainly in the upper part they are distinctly warty.

Ascospores: 8/ascus, hyaline, submuriform, 4–5/2-celled, 12–14 × 5–6 µm, + ca. 1–2 µm halo. Ascospores turn I+ weakly blue (interlocular plates), halo I-. Spore locules are rounded, elliptical or lens shaped.

Chemistry: Salazinic acid, protocetraric acid (trace), norstictic acid (trace).

Specimens examined:

AUSTRALASIA

Australia: Queensland: Westlich von Palm Cove, etwa 25 km N von Cairns. In einem feuchten Küstenregenwald. 60 m. 16°45'S; 145°40'E. VIII.1988. K. Kalb 19939 (KALB). - dto. 19940 (KALB). - dto. 19936 (KALB).

NORTHERN AMERICA

Southeastern U.S.A.: Florida: Miami: See type specimen *Graphina plittii*.

SOUTHERN AMERICA

Caribbean: Cuba: In wood, Sept. 16 (??) leg. Ch. Wright 23 (M).

South America: Guyana: H. Sipman, Lichenotheca Latinoamericana 125. Upper Mazaruni District, Mt. Latipu, c. 8 km N of Kamarang. 05°57'N, 60°38'W. 600m. In c. 15 m tall forest on N-foot, on 50 cm diam. treetrunk. II. 1985. H. Sipman & A. Aptroot 19004 (KALB).

Brazil: **Mato Grosso:** Etwa 35 km S von Cuiaba, in einem dunklen Cerrado. 120 m. VII. 1980. K. Kalb. 28864 (KALB). - **Amazonas:** Regenwälder am Rio Negro, zwischen 100 und 200 km flußaufwärts von Manaus. 40 m. X. 1980. K. Kalb 28853 (KALB).

Remarks:

(1) WIRTH & HALE (1978) list *Graphis intricata* Eschw. and *Graphina plittii* Zahlbr. as synonyms. We could not locate the type of *Graphis intricata* Eschw. in Munich but we confirm their observation concerning *Graphina plittii* Zahlbr.

(2) The white tissue that covers the carbonized margins is formed by the periphysoids and does not contain algae. Therefore it should be distinguished from a **thalline** cover.

(3) *Graphina amicta* Nyl. is a quite similar species differing in slightly

larger ascospores that turn I+ red violet and a more distinctly carbonized excipulum (see remark *Graphina amicta* Nyl.)

Graphis candidata Nyl.

NYLANDER, W. Flora 52: 72 (1874).

Holotype: Brazil, Paricatuba ad fl. amazon. Spruce, Lichenes Amazonicos et Andinos No. 292. H-NYL 7538! (Protocetraric acid, fide annotation by Nakanishi 1973; the thallus contains lichexanthone, too, as it shows a yellow fluorescence under UV light.)

= *Graphis singaporina* Nyl.

NYLANDER, W. Sertum Lichenaeae tropicae e Labuan et Singapore: 23. (1891).

Lectotype: (designated here; proposed by Awasthi & Mathur 1979 - annotation label but not published): Singapore. H-NYL 7575. (Protocetraric acid, fide annotation Nakanishi 1973; the thallus contains lichexanthone too, as it shows a yellow fluorescence under UV light).

Thallus: White to cream-coloured, dull, slightly fissured, UV+ yellow.

Ascocarps: ± oblong, rarely branched, slightly flexuose, distinctly raised from the thallus, with a thalline cover. Sometimes this cover is rubbed away and the carbonized margins are visible. The disc is slit-like, concealed by the margins.

Excipulum: Totally carbonized, closed, sometimes crystals are embedded between the carbonized excipulum and the thalline cover

Hymenium: 100–110 µm high.

Paraphyses: Ca. 1–1.5 µm thick, close to each other, unbranched. **Periphysoids** short (ca. 5 µm), hyaline with warty tips. They grow out of the carbonized excipulum/the margins into the slit, formed by the margins.

Ascospores: 4–8/ascus, hyaline, with transverse septa only, 17–25-celled, 55–100 × 7–9 µm, I- or faintly light-blue. Spore locules cylindrical to rounded.

Chemistry: Protocetraric acid, lichexanthone.

Specimens examined:

SOUTH AMERICA

Venezuela: Hochland von Guayana, Estado Bolivar,: Umgebung Canaima (6°3'N, 62°39'W) am Rio Carrao, 550 m. 31.3.1969. H. Hertel, B. & F. Oberwinkler. Hertel Nr. 10073 (M).

Brazil: Brazil North: Amazonas: See type specimen of *Graphis candidata.*

ASIA-TROPICAL

Malesia: Malaya: Singapore: See type specimen of *Graphis singaporina.*

Remarks:

(1) The ascospore size depends on the number of spores per ascus. As the

number of spores per ascus ranges from 4 to 8 the spore size shows a rather large variability (55–95 µm).

(2) Nakanishi already notes on an annotation label (1973) "*Graphis singaporina* Nyl. = *Graphis candidata* Nyl." We can confirm this observation as all characteristics are corresponding.

(3) WIRTH & HALE (1963) remark that *Graphis vermiformis* (Eschw.) Nyl. (= *Graphis illinata* var. *vermiformis* Eschw.) should be the correct name for this species as "Nylander's elevation of var. *vermiformis* to species level antedates the publication of *Graphis candidata* by 16 years". ZAHLBRUCKNER (1923) lists *Graphis vermiformis* as older synonym to *Graphis candidata*. Unfortunately we could not find ascospores in the type specimen of *Graphis illinata* var. *vermiformis* Eschw. in Munich and therefore it was not possible to make sure if the two species are really conspecific.

Graphis chionophora Redinger

REDINGER, K. Ark. Bot. 27 A (3): 13 (1935).

Holotype: Brazil, Matto Grosso: Santa Anna da Chapada, 6.3.1894, leg. G. A. Malme Nr. 2512 A. S! (Protocetraric acid, lichexanthone).

Fig.: 5.

Thallus: Light-grey, yellowish, dull, uneven and slightly warty and slightly cracked. UV+ yellow.

Ascocarps: Short or ± oblong (2–3 × 0.5 mm), rarely branched and concolourous with the thallus but raised and with prominent, carbonized margins that are totally covered by a white, thalline layer. The disc is concealed, only a slit is visible. Along the slit the thalline cover is white-mealy and much paler than the rest of the thallus.

Excipulum: Totally carbonized, closed, covered with a thalline layer in the lower part (containing algae) and with a layer of hyaline hyphae/periphysoids (without algae) in the apical part.

Hymenium: Ca. 90–100 µm high.

Paraphyses: Tips without warts. **Periphysoids** develop from the carbonized excipular hyphae and can reach 20–30 µm length. At least the tips are distinctly warty.

Ascospores: 8/ascus, hyaline, with transverse septa only, 6–9-celled, 20–25 × 6–8 µm, I-, spore locules cylindrical or rounded, not lens shaped.

Chemistry: Lichexanthone present or absent, protocetraric acid.

Specimens examined:

SOUTH AMERICA

Brazil: **Paraiba:** Alhandra, ca. 50 km s von João Pessoa, 60 m. IX. 1993. R. Türk & L. Xavier 27204 (KALB). - **Mato Grosso:** Serra dos Coroados, Buriti, in einem lichten Wäldchen bei der evangelischen Schule Buriti. 600 m. VII. 1980. K. Kalb 28845 [a] (KALB). - dto. 28846 (KALB).

Remarks:

(1) According to the protologue, the ascospores should be ”J+ coerulescentes”. Our specimens have been collected at the same localities as the type material and they, as well as the type, show ascospores which are J-.
(2) The specimen from Paraiba is identical with the other specimens mentioned in every respect, but differs in the lack of lichexanthone. We do not consider this deserving taxonomic attention.

Graphis cf. *sauroidea* Leight.

Leighton, W. A. Trans. Linn. Soc. London 25: 452 (1866).

Type: Obidos (Brazil, Para), leg. Spruce. BM.

Thallus: Olive green, smooth, with small warts, cortex well developed.

Ascocarps: Oblong, ± branched lirellae, more or less raised from the thallus (depending on the age). The carbonized margins are totally covered by a thalline layer. The disc is concealed, slit-like. Near the slit the ascocarp is white-mealy.

Excipulum: Carbonized; in young ascocarps the carbonization at the base is only poorly developed or lacking. The carbonized margins form a deep slit; the inner side of the slit is covered by warty periphysoids. In older ascocarps a layer of yellowish or brownish hyphae surrounds the hymenium and reacts at least in parts I+ blue. Eventually this layer consists of old hymenial hyphae.

Hymenium: Ca. 120 µm high, slightly inspersed.

Paraphyses: Thin, (ca. 1 µm), unbranched and closely adjoining, tips not thickened, without warts, hyaline. **Periphysoids** short (ca. 10 µm), warty but mostly indistinctly.

Ascospores: 6–8/ascus, hyaline, with transverse septa only, 10–14-celled, 23–35 × 6–7 µm, I-. Spore locules lens shaped.

Chemistry: Stictic acid, constictic acid, menegazziaic acid, hypostictic acid (trace).

Specimens examined:

SOUTH AMERICA

Brazil: Amazonas: Im Überschwemmungsgebiet des Rio Preto, kurz vor der Mündung in den Amazonas, 80 km E von Manaus. 40 m. 03°10'S, 59°50'W. VIII. 1993. K. & A. Kalb. 27798 (KALB). - dto. 27114 (KALB). - dto. 27106 (KALB). - dto. 27089 (KALB).

Remarks:

(1) REDINGER (1935) indicates in his description of *Graphis sauroidea* that the ascospores were I+ blue. In our samples we could not see this. Nevertheless the shape of the exciple and the other characters match well our samples. Therefore we use this name and hope that the study of the type will reveal the discrepancies.

Phaeographina crassa **(Müll. Arg.) Redinger**

REDINGER, K. Arkiv för Botanik 26 A (1): 85 (1933).

≡ *Graphina crassa* Müll. Arg., Journ. Linn. Soc. London, Bot. 30: 459 (1895).

Holotype: Brasilia, in prov. Rio de Janeiro, 1857, leg. Glaziou. G!

Fig.: 35.

Thallus: Olive-green, dull, uneven, slightly fissured or areolate.

Ascocarps: Short to oblong lirellae (2–3 × 1 mm), not branched, little flexuose. The margins are distinctly raised and have a thalline cover. The disc is slit like, concealed by the margins. The slit is yellowish pruinose.

Excipulum: The hymenium is totally enclosed by the excipulum. The excipulum is carbonized; many crystals are embedded in the outer side of the carbonized tissue as layer between thalline cover and carbonized excipulum.

Hymenium: Ca. 100–110 µm high, gelatinous, a yellowish layer of hyphae is below and next to the hymenium and seems to develop from parts of the old hymenia.

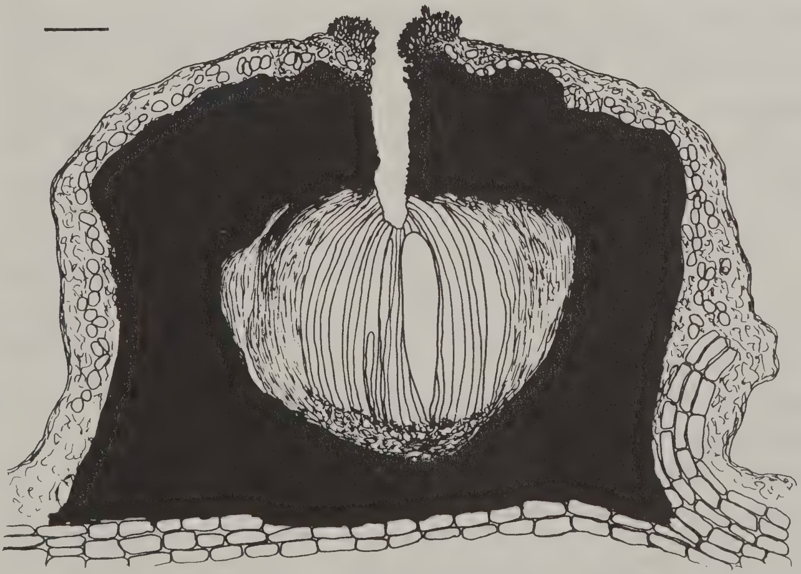

Fig. 35

Fig. 35: *Phaeographina crassa*; bar = 30 µm

Paraphyses: Thin, (1 µm) tips not thickened, not warty. The hyaline **periphysoids** seem to grow out of the carbonized excipular hyphae. They jut into the slit formed by the margins and have distinctly warty tips.

Ascospores: 1/ascus, hyaline to light-yellow or light-brown, muriform, 35–50/5–8-celled, 120–180 × 25–30 µm, I- or faint reddish.

Chemistry: Stictic acid, constictic acid, cryptostictic acid. (The type material was too scarce for chemical investigations.)

Specimens examined:

SOUTH AMERICA

Brazil: Bahia: Gegenüber der Stadt Porto Seguro, in einem alten Stranddünenewald (Restinga), am Fluß Buranhém. 3 m. VII. 1980. K. Kalb. 28817 (KALB). **São Paulo:** Ilha Comprida gegenüber von Cananeia, in einem sehr feuchten Stranddünenwald (Restinga) 3 m. VII. 1979. K. Kalb *31134 (KALB). - **Rio de Janeiro:** See type specimen.

Remarks:

(1) Specimens marked with "*" have less prominent, smaller (young ?) ascocarps than the type.

Graphina subalbotecta ad int.

Thallus: Light grey to greenish with rough, dull surface, slightly fissured.

Ascocarps: oblong, ± flexuose rarely branched lirellae. Margins prominent; totally covered by a thalline layer but paler than the thallus. Disc slit-like, concealed. The slit often white mealy.

Excipulum: Carbonized (at the base sometimes only poorly carbonized), rounded to pear-shaped. The margins are totally covered by a thalline layer. Often a layer of crystals is embedded between excipulum and thalline cover.

Hymenium 160–200 µm high.

Paraphyses with tips not warty. **Periphysoids** develop from the edges of the carbonized margins and grow into the slit and to the visible upper part of the margin forming the mealy cover.

Ascospores: 2–8/ascus, hyaline, muriform, slightly tailed, 19–25/3–5-celled, 55–90 × 11–18 µm, I-.

Chemistry: Lichexanthone, protocetraric acid.

Specimens examined:

SOUTH AMERICA

Brazil: Mato Grosso: Zwischen Jaciara und São Vincente, etwa 100 km ESE von Cuiaba, in einem Cerrado. 750m. VII. 1980. K. Kalb 28860 (KALB). - dto. 28848 (KALB). - Zwischen São Vincente und Aquas Quentes, etwa 90 km ESE von Cuiaba, in einem dichten Galerie-Wald. 650 m. VII. 1980. K. Kalb 28847 (KALB).

Remarks:

(1) This species is very similar to *Graphis chionophora* Redinger and differs only in larger, muriform ascospores.

(2) The material is quite scarce and several other names should be checked. Therefore we hesitated to formally describe it as a new species.

3.6.4. Species with warty periphysoids and paraphysis-tips not belonging to the family Graphidaceae

Chroodiscus brasilianus (Hale) Staiger & Kalb comb. nov. (Thelotremataceae)

HALE, M. in KALB, K. Lichenes neotropici. Fascikel VII: 15 (1983).

Holotype: Brazil, Mato Grosso, Serra da Chapada, 3. Juni 1894. leg. G. A. Malme Nr. 3558. S. (Nil).

= *Thelotrema carneoradians* Sipman, Tropical Bryology 6: 10 (1992).

Holotype: Venezuela, Estado Bolivar, Cerro Guaiquinima, surroundings of camp 7, at confluence of rives Carapo and Lima, coord. 5°35' N, 63°32' W, alt. c. 350 m. c. 15 m tall, light forest on poor soil on W-bank of Carapo, 1. Feb. 1990, H. Sipman 26355.VEN. (Nil).

Thallus: Olive green to ochre, smooth with few long isidia.

Ascocarps: Round or irregularly star-like, chroodiscoid. Thalline margins folded back exposing the disc. Disc and inner side of the margin white pruinose.

Excipulum: Uncarbonized, poorly developed at the base.

Hymenium: 80–90 µm.

Paraphyses: Tips distinctly warty. **Periphysoids** ca. 5 µm long, distinctly warty (fig. 33).

Ascospores: 8/ascus, hyaline, mostly with transverse septa only, rarely submuriform, 6–8/1–2-celled, 13–16 × 4–5 µm +2 µm halo; I-, spore locules cylindrical (fig. 12).

Chemistry: Nil.

Specimens examined:

SOUTH AMERICA

Brazil: São Paulo: Kalb, Lichenes Neotropici 298. Ilha de São Sebastião, etwas 130 km E von São Paulo, Westhang des Morro das Tacas, in einem sehr feuchten und dunklen Regenwald an einem Fluß. 400 m. VII. 1979. K. Kalb 21318 (KALB). - Serra do Itapeti, zwischen Mogi das Cruzes und Arujá, in einem alten, dichten Hangwald. 500 m. IV. 1980. K. Kalb. 31348 (KALB). - **Amazonas:** Regenwälder am Rio Negro, zwischen 100 und 200 km flußaufwärts von Manaus. 40 m. X. 1980. K. Kalb 31282 (KALB).

Remarks:

(1) *Thelotrema carneoradians* Sipman is conspecific with *Chroodiscus brasilianus* (Hale) Staiger & Kalb as it corresponds in all important character states. SIPMAN (1992) considers the isidia to be a part of another lichen. We have observed this character in all specimens listed above and examined it carefully. We conclude that the isidia really belong to the lichen thallus of *Chroodiscus brasilianus*.

KALB 31325 (systematic position unclear)

Thallus: Light-grey, dull and with small warts or powdery, slightly cracked.

Ascocarps: Rounded to oval or oblong (1–3 × 0.5–1 mm) ± flexuose, rarely branched, distinctly raised from the thallus. Margins bulging, concolourous with the thallus or paler. Disc concealed or open (transitions on one thallus observable).

Excipulum: Uncarbonized, at the base poorly developed, laterally a parathecium is developed and the lengthening of it generates the periphysoids. The outer excipulum is consisting of loosely arranged hyphae.

Hymenium: 150–180 µm high.

Paraphyses. Thin, (1 µm) with gelatinous layer, tips branched or indistinctly warty. **Periphysoids** develop from the lengthening of the parathecium and especially those at the tips of the margins are long (10–20 µm) and distinctly warty along several segments.

Ascospores: 1/ascus, hyaline, with transverse septa, sometimes appearing submuriform due to plasmodesma, 15–18-celled, 120–150 × 20–30 µm, I-. Spore locules cylindrical or rounded.

Chemistry: Norstictic acid , connorstictic acid.

Specimens examined:

SOUTH AMERICA

Brazil: Brazil West-central: **Mato Grosso:** etwa 35 km SE von Cuiaba, in einem Cerrado, mit kleinen eisenhaltigen Felsen.120 m. VII. 1980. K. Kalb 28910 (KALB). - **Mato Grosso do Sul:** Zwischen Rio Verde do Mato Grosso und Coxim, in einem dichten Cerradão (Bachschlucht). 400 m. VI. 1980. K. Kalb 31325 (KALB).

Remarks:

(1) The ascus type of this species differs considerably from a typical *Graphis*-ascus as well as the paraphyses (compare figures 1 and 2). The systematic position of this species remains unclear. In spite of the conspicuous characters it was not possible to find even a generic name for this species.

KALB 29942 (systematic position unclear)

Thallus: Thin, mealy (cortex lacking), grey-green.

Ascocarps: Short or ± oblong (0.5–2 × 0.1–0.2 mm), flexuose and branched lirellae, distinctly raised from the thallus. Carbonized margins are covered by a white-mealy layer that is easily rubbed away (similar to *Graphina marcescens*). The disc is not visible, the margins form a narrow slit.

Excipulum: Totally carbonized, broader at the base. The excipula of closely neighboured lirellae are often confluent at the base.

Hymenium: Ca. 60 µm high.

Paraphyses: 1–1.5 µm thick, tips slightly thickened but without warts. **Periphysoids** develop from the carbonized margins. They consist of short segments with warts. They are larger than in the other species and resemble short branches.

Ascospores: 8/ascus, hyaline, submuriform, 4/2-celled, 9–11 × 4–5 µm, I-. Spore locules cylindrical, not rounded or lens-shaped.

Chemistry: Stictic acid, constictic acid.

Specimens examined:

SOUTH AMERICA

Brazil: Amazonas: Im Überschwemmungsbereich des Rio Preto, kurz vor der Mündung in den Amazonas, ca. 80 km E von Manaus. 40 m. 03°10'S, 59°50'W. VIII. 1993. K. & A. Kalb 29942 (KALB).

Remarks:

(1) The ascus type indicates, that this species is no member of the family Graphidaceae (compare figures 1 and 3). Also the ascospores without distinct endospore differ considerably from other Graphidaceae.
(2) We could not make sure if the large "warts" of the periphysoids are formed by the cell wall or if the periphysoids are branched regularly.

KALB 28829 (systematic position unclear)

Thallus: Light grey, yellowish, dull mealy (lacking a cortex) with incrusted crystals, ca. 100 µm.

Ascocarps: Short to oblong (0.5–2 × 0.4 mm) crowded, ± branched and flexuose. Embedded in the thallus; only the upper part may be emerged. Margins carbonized with pruinose cover (grey coloured). Disc slit like.

Excipulum: Carbonized, below the hymenium the excipulum is sometimes only poorly developed and not carbonized. The margins are convergent, carbonized and the tip/the edge is covered by a thin layer of hyaline hyphae (without algae).

Hymenium: Ca. 70–80 µm high.

Paraphyses: Ca. 1.5 µm thick surrounded by a gelatinous mass. The tips are not warty; the lateral paraphyses are slightly connected. The **periphysoids** develop from the edge of the margin and loom into the slit formed by the margins. They are short (max. 5–10 µm) and usually only the last segment is warty.

Ascospores: 4–8/ascus, hyaline, with transverse septa only, 3–4-celled, 10–12 × 4–5 µm, I-. Spore locules lens shaped. Young ascospores may have a distinct halo (ca. 2 µm) that is usually lacking in mature and older ascospores.

Chemistry: Norstictic acid.

Specimens examined:

SOUTH AMERICA

Brazil: Bahia: Serra das Mangabeiras, etwa 8 km vor Seabra, in einem Cerradão. 1050 m. VII. 1980. K. Kalb. 28829 (KALB).

Remarks:

(1) The ascus-, spore- and paraphysis-types differ from those in *Graphis* (compare figures 1 and 4), but lack of more material makes any further conclusions impossible.

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4. Literature cited

CLEMENTS, F. E. 1909. The genera of fungi. Minneapolis, 227 pp.
CLEMENTS, F. E. & SHEAR, C. L. 1931. The genera of fungi. New York, 496 pp.
CULBERSON, C. F. & KRISTINSSON, H. 1970. A standardized method for the identification of lichen products. - J. Chromatogr. 46: 85-93.
CULBERSON, C. F. 1972. Improved conditions and new data for the identificaton of lichen products by a standardized thin-layer chromatographic method. - J. Chromatogr. 72: 113 - 125.
CULBERSON, C. F. & JOHNSON, A. 1982. Substitution of methyl tert.-butyl ether for diethyl ether in the standardized thin-layer chromatographic method for lichen products. - J. Chromatogr. 238: 483 - 487.
ECKFELDT, J. W. 1889. New North American lichens. - Bull. Torrey Bot. Club. 16: 104-120.
ERIKSSON, O. E. & HAWKSWORTH, D. L. 1998. Outline of the ascomycetes - 1998. - Syst. Ascomycetum 16: 83-296.
FÉE, A. L. A. 1824. Méthode lichénographique et genera. Paris, 102 pp.
FÉE, A. L. A. 1825 [1824]. Essai sur les cryptogames des écorces exotiques officinales. Paris, 167 pp.
HALE, M. E. 1974. Morden-Smithsonian Expedition to Dominica: The Lichens (Thelotremataceae). - Smithsonian Contr. Bot. 16: 1-46.
HALE, M. E. 1978. A revision of the lichen family Thelotremataceae in Panama. - Smithsonian Contr. Bot. 38: 1-60.

HALE, M. E. 1981. A revision of the lichen family Thelotremataceae in Sri Lanka. - Bull. Brit. Mus. (Natural History) Bot. Ser. 8: 227-332.

HARRIS, R. C. 1990. Some Florida lichens. - Publ. by the author. Bronx, N. Y., 109 pp.

HARRIS, R. C. 1995. More Florida lichens including the 10¢ tour of the pyrenolichens. - Publ. by the author. Bronx, N. Y., 192 pp.

HAWKSWORTH, D. L. (ed.). 1994. Ascomycete systematics. Problems and perspectives in the nineties. - London, 453 pp.

HAWKSWORTH, D. L., KIRK, P. M., SUTTON, B. C. & PEGLER, D. N. 1995. Dictionary of the fungi. Kew, 616 pp.

HENSSEN, A. & JAHNS, H. M. 1974. Lichenes. Eine Einführung in die Flechtenkunde. Stuttgart, 467 pp.

HOLLIS, S. & BRUMMIT, R. K. 1992. World geographical scheme for recording plant distributions. 1-105. Pittsburgh.

KALB, K. 1982. Lichenes neotropici. Fascikel III (no. 81-120). Neumarkt/OPf., 12 pp.

KALB, K. 1983. Lichenes neotropici. Fascikel VII (no. 251-300). Neumarkt/OPf., 16 pp.

KALB, K. & HAFELLNER, J. 1992. Bemerkenswerte Flechten und lichenicole Pilze von der Insel Madeira. - Herzogia 9: 45-102.

LEIGHTON, W. A. 1866. Lichenes Amazonici et Andini lecti a Domino Spruce. - Trans. Linn. Soc. London: 433-460.

MAKHIJA, U. ADAWADKAR, B. & PATWARDHAN, P. G. 1992. Materials for a lichen flora of the Andaman Islands: VIII - The genus *Graphina*. - Biovigyanam 18 (1): 21-32.

MATHEY, A., VAN ROY, W., VAN VAECK, L., ECKHARDT, G., & STEGLICH, W. 1994. *In situ* analysis of a new perylene quinone in lichens by Fourier-transform laser microprobe mass spectrometry with external source. - Rapid communications in mass spectrometry 8: 46-52.

MÜLLER. ARG., J. 1880. Lichenologische Beiträge 10. - Flora 63: 17-24, 40-45.

MÜLLER ARG., J. 1882. Lichenologische Beiträge 15. - Flora 65: 291-306, 316-322, 326-337, 381-386, 397-402.

MÜLLER ARG., J. 1887. Graphideae Féeanae inclus. trib. affinibus nec non Graphideae exoticae Acharii, El. Friesii et Zenkeri e novo studio specimінum originalium expositae et in novam dispositionem ordinatae. - Mém. Soc. Phys. Genève 29 (8): 1-80.

MÜLLER ARG., J. 1895. Graphideae Eckfeldtianae in Louisiana et Florida. - Bull. Herb. Boissier III (2): 41-50.

MÜLLER ARG., J. 1895. Thelotremeae et Graphideae novae quas praesertim ex herb. Kewensi exponit. - Journ. Linn. Soc. London, Bot. 30: 451-463.

NAKANISHI, M. 1966. Taxonomical studies on the family Graphidaceae of Japan. - J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 11: 51-126.

NYLANDER, W. 1863. Lichenes, in: TRIANA, J. & PLANCHON, J. E., Prodromus florae Novo-Granatensis ou Énumération des plantes de la

Nouvelle-Grénade avec description des espèces nouvelles. - Ann. Sci. Nat., sér. 4 (Bot.), 19: 286-382; 20: 228-279.

NYLANDER, W. 1868. Synopsis lichenum Novae Caledoniae. - Bull. Soc. Linn. Normand. ser.2., 2: 39-140.

NYLANDER, W. 1874 (1873). Lichenes insularum Andaman. - Bull. Soc. Linn. Normand., sér. 2, 7: 162-182.

NYLANDER, W. 1874. Animadversiones circa Spruce, Lichenes Amazonicos et Andinos. - Flora 52: 70-73.

NYLANDER, W. 1888a. Lichenes Fuegiae et Patagoniae. Paris, 36 pp.

NYLANDER, W. 1888b. Lichenes Novae Zelandiae. Paris, 156 pp.

NYLANDER, W. 1891. Sertum Lichenaeae tropicae e Labuan et Singapore. Paris, 48 pp.

POELT, J. 1969. Bestimmungsschlüssel europäischer Flechten. Lehre, 757 pp.

REDINGER, K. 1933[a]. Clavis Graphidearum Philippinensium secundum E. A. VAINIO Lich. Ins. Philipp. redacta. - Ann. Naturhist. Mus. Wien 47: 115-126.

REDINGER, K. 1933[b]. Die Graphidineen der ersten Regnell'schen Expedition nach Brasilien 1892-1894. II. *Graphina* und *Phaeographina*. - Ark. Bot. 26 A (1): 1-105.

REDINGER, K. 1935. Die Graphidineen der ersten Regnellschen Expedition nach Brasilien 1892-1894. III. *Graphis*, *Phaeographis*, nebst einem Nachtrage zu *Graphina*. - Ark. Bot. 27 A (3): 1-103.

SIPMAN, H. J. M. (1992). Results of a lichenological and bryological exploration of Cerro Guaiquinima (Guayana Highland, Venezuela). - Tropical Bryology 6: 1-31.

SPEGAZZINI, C. L. 1889. Fungi puiggariani. - Bol. Acad. Nac. Ci. Cordoba 11: 381-622.

VAINIO, E. V. 1890. Etudes sur la classification naturelle et la morphologie des lichens du Brésil, pars II. - Acta Soc. Fauna Fl. Fenn. 7 (2): 1-256.

VAINIO, E. V. 1921. Lichenes insularum Philippinarum, III. - Ann. Acad. Sci. Fenn. ser. A 15 (6): 1-368.

WATSON, W. 1929. The classification of lichens. - New Phytol. 28: 1-68.

WIRTH, M. & HALE, M. E. 1963. The lichen family Graphidaceae in Mexico. - Contrib. U. S. Nat. Herb. 36 (3): 63-118.

WIRTH, M. & HALE, M. E. 1978. Morden-Smithsonian Expedition to Dominica: The Lichens (Graphidaceae). - Smithsonian Contr. Bot. 40: 1-64.

ZAHLBRUCKNER, A. 1923. Graphidaceae, in: Catalogus lichenum universalis 2(2-3): 145-452.

ZAHLBRUCKNER, A. 1926. Lichenes (Flechten) B. Spezieller Teil, in: ENGLER, A. & PRANTL, K. Die natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten insbesondere den Nutzpflanzen. 8: 61-263.

ZAHLBRUCKNER, A. 1928. Lichenes (Decades 77-78), in: KEISSLER, C. Schedae ad "Kryptogamas exsiccatas." - Ann. Naturhist. Mus. Wien 42: 60-66.

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Herbarium Ustilaginales Vánky (HUV)
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ABSTRACT

Graminicolous smut fungi of the tribe Pappophoreae and of the genera *Dactyloctenium*, *Digitaria*, *Elionurus*, *Iseilema* and *Lepturus* have been studied, as well as some other smut fungi from different parts of the world.

NEW SPECIES proposed: *Sporisorium elionuri-tristis* K. Vánky (type on *Elionurus tristis*, Madagascar); *S. iseilematis-vaginiflori* K. Vánky (type on *Iseilema vaginiflorum*, Australia); *Ustilago austro-africana* K. & C. Vánky (type on *Enneapogon cenchroides*, Zimbabwe); *U. lepturi-xerophili* K. Vánky (type on *Lepturus xerophilus*, Australia); *U. radulans* K. Vánky (type on *Dactyloctenium radulans*, Australia); and *U. viviparifera* K. & C. Vánky & N. D. Sharma (type on *Dactyloctenium aegyptium*, India).

NEW COMBINATIONS proposed: *Farysia caricis-petitianae* (Zundel) K. Vánky, based on *Sphacelotheca caricis-petitianae* (type on *Carex petitiana*); *Sporisorium diplosporum* (Ellis & Everhart) K. Vánky, based on *Ustilago diplospora* (type on *Digitaria sanguinalis*); *Sporisorium dolichosorum* (Ainsworth) K. Vánky, based on *Sphacelotheca dolichosora* (type on *Digitaria longiflora*); *Sporisorium elionuri* (Henn. & Pole-Evans) K. Vánky, based on *Ustilago elionuri* (type on *Elionurus muticus*); *Sporisorium linderi* (Zundel) K. Vánky, based on *Sphacelotheca linderi* (type on *Digitaria horizontalis*).

SYNONYMS: Both *Sphacelotheca digitariae-pedicellaris* J. N. Mishra (type on *Digitaria pedicellaris*) and *Ustilago belgiana* Zundel (lectotype on *Digitaria horizontalis*) are *Ustilago syntherismae* (Schwein.) Peck (type on *Digitaria* sp.); *Sporisorium pole-evansii* K. Vánky (type on *Digitaria eriantha*) is *Sporisorium linderi* (Zundel) K. Vánky (type on *Digitaria horizontalis*); *Ustilago longiflora* Mundkur & Thirumalachar (type on *Digitaria longiflora*) is *Ustilago royleani* H. & P. Sydow & Butler (type on *Digitaria stricta*).

EXCLUDED SPECIES: *Tuburcinia penniseti* J. N. Mishra (type on *Pennisetum hordeoides*) is *Phakopsora apoda* (Pat. & Har.) Mains (Uredinales). Both *Ustilago parvula* H. Sydow (type on *Ischaemum arundinaceaum*) and *Ustilago setariae-aureae* Henn. (type on *Setaria aurea*) are *Ustilaginoidea* species (Mitosporic fungi, Fungi Imperfecti).

LECTOTYPE is designated for *Ustilago belgiana* Zundel (= *U. syntherismae* (Schwein.) Peck).

Key words: smut fungi, new species, new combinations, excluded species

THE SMUT FUNGI OF THE TRIBE *PAPPOPHOREAE* (GRAMINEAE)

The tribe Pappophoreae, in the subfamily Chloridoideae, contains five genera: *Cottea, Enneapogon, Kaokochloa, Pappophorum* and *Schmidtia* (Clayton & Renvoize, 1986). Relatively few Ustilaginomycetes have been published on members (c. 40 spp.) of these genera. The recognised five species of smut fungi with their synonyms are:

1. *Ustilago pappophori* Patouillard, 1906:199.

Sphacelotheca pappophori (Patouillard) Zundel, 1938:300 & 1953:104. — Type on *Pappophorum scabrum* Kunth (= *Enneapogon scaber* Lehm.), Algeria, oasis Adrar between In-Salah and Ahaggar, 1905, coll. Mr. R. Chudeau. Holotype in FH, isotype in BPI 165184!

Ustilago pappophori Patouillard var. *magdalensis* Hirschhorn, 1939:398. — *Ustilago magdalensis* (Hirschh.) Hirschhorn, 1942:217. — Type on *Pappophorum subbulbosum* Arech. (= *P. mucronulatum* Nees), Argentina, Buenos Aires, Magdalena, XI.1935, E. Hirschhorn, Herb. Spegazzini, LPS 3073 (n.v.; synonymy according to Zundel, 1953:104, and Hirschhorn, 1986:131).

Ustilago pappophori H. Sydow, 1926:265 (later homonym, not Pat., 1906), on *Pappophorum scabrum* Kunth, South Africa, Klein Karas, 11.XI.1923, Dinter.

Sori destroying the whole inflorescence and also the basal part of the uppermost leaves, 3–6 x 5–10 mm, partly hidden by the uppermost leaves and remnants of host tissue which rupture irregularly and flake away disclosing the dark brown, powdery masse of spores surrounding the axis of the inflorescence which appears as a thick columella with short branches. *Spores* subglobose to ellipsoidal, 7–10.5 x 9.5–12 µm, olivaceous-brown; wall even, 1–1.5 µm thick, moderately densely echinulate; spore profile serrulate. In SEM, spore surface between the spines finely verrucose.

On *Enneapogon* and *Pappophorum*: *E. desvauxii* P. Beauv. (*E. brachystachyum* (Jaub. & Spach) Stapf; *P. wrightii* S. Wats.), *E. scaber* Lehm. (*P. scabrum* Kunth) *P. mucronulatum* Nees (*P. subbulbosum* Arech.); Africa, South America.

The name ***Ustilago pappophori*** H. Sydow, 1926:265, is a later homonym (not Patouillard, 1906), on *Pappophorum scabrum* Kunth, South Africa, Klein Karas, 11.XI.1923, coll. Dinter. I did not see this specimen but, judged from the description, it most probably represents *U. pappophori* Pat. on the same host plant.

2. *Sporisorium modestum* (H. Sydow) H. Scholz, in Fraiture, 1997:171. *Ustilago modesta* H. Sydow, 1935:231. — *Sphacelotheca modesta* (H. Sydow) Zundel, 1938:301. — Type on *Enneapogon brachystachyum* (Jaub. & Spach) Stapf (= *E. desvauxii* P. Beauv.), Rep. of South Africa, Cape Prov., Prieska, 19.III.1928, E. G. Briant (PREM 23506!).

Sori in all flowers of an inflorescence, comprising the ovaries and the basal part of the inner floral envelopes, 1–1.5 x 1.5–2.5 mm, apiculate, covered by a delicate, yellowish peridium which flakes away disclosing the blackish-brown, first agglutinated later dusty mass of spores intermixed with sterile cells, and a short (0.5–1.5 mm), central, irregular columella. Mature *spores* single, globose to broadly ellipsoidal, 9–12(–13) x 11–14 µm, olivaceous-brown, evidently, rather densely echinulate, spines 0.5–1 µm high. *Sterile cells* in irregular groups. Single cells globose to ellipsoidal, 5.5–10 µm long, hyaline, thin-walled (c. 0.5 µm), smooth.

On *Enneapogon desvauxii* P. Beauv. (*E. brachystachyum* (Jaub. & Spach) Stapf, *Pappophorum wrightii* S. Wats.); Africa (Rep. of South Africa, Sudan).

3. *Ustilago enneapogonis* G. W. Fischer, 1952:8.

Type on *Enneapogon desvauxii* P. Beauv., USA, Arizona, Cochise, X.1900, coll. D. Griffiths. — Isotypes in Griff., W. Amer. fgi. No. 224 (as *Ustilago minor* Nort. on *Pappophorum wrightii* Wats.), BPI 796752!

Sori destroying the whole inflorescence, rarely only the spikelets, bullate, globoid to cylindrical, narrowing distally into an acute tip, 1–2 x 2–8 mm, with remnants of aborted spikelets, especially on the distal part of the sori. Sori often more or less completely enclosed by leaf sheaths or protruding and evident, at first covered by a delicate greyish membrane which ruptures irregularly to expose the rather agglutinated, dark brown spore masses. *Spores* globose, subglobose to ellipsoidal, 9.5–12.5 x 10.5–13.5(–14.5) µm, yellowish- to reddish-brown; wall even, c. 1 µm thick including the rather sparsely situated spines which cause the spore profile to appear finely serrulate.

On *Enneapogon desvauxii* P. Beauv. (*E. brachystachyum* (Jaub. & Spach) Stapf; *Pappophorum wrightii* S. Wats.), *E. nigricans* P. Beauv. (*E. flavescens* (Lindl.) N. T. Burb.); North America (Mexico, USA), Australia.

Remark. "*Ustilago hieronymi* Schröt." on *Pappophorum wrightii* in Vgr., Micr. rar. sel. No. 896 is *U. enneapogonis* (HUV 3406!).

4. *Ustilago schmidtiae* K. Vánky, 1997a:135.

Type on *Schmidtia pappophoroides* Steudel ex J. A. Schmidt, Africa, Kenya, Makueni, alt. 3500 feet, I.1960, leg. A. V. Bogdan. Holotype in HUV 17383!, isotypes in Herb. Dept. Agric., Nairobi (3150) and in IMI 82029.

For description and illustration see Vánky, 1997a:133-136.

On *Schmidtia pappophoroides* Steudel ex J. A. Schmidt; East Africa (Kenya).

5. *Ustilago austro-africana* K. & C. Vánky, sp. nov.

Typus in matrice *Enneapogon cenchroides* (Roem. & Schult.) C. E. Hubb., Zimbabwe, Midlands Prov., 13 km S.W. urbe Zwishawane, 20°21'19" S, 29°57'20" E, alt. cca. 950 m, 2.III.1999, C. & K. Vánky. Holotypus in Herbario Ustil. Vánky (HUV 18885!). Isotypi in Vánky, Ust. exs. No. 1062 (ineditus). Paratypus in matrice *E. cenchroides*, Rep. of South Africa, Mpumalanga Prov., Drakensberg Mts., cca. 34 km N.N.E. Ohrigstad, 24°33,15" S, 30°44'00" E, alt. cca. 1110 m, 22.I.1997, leg. C. & K. Vánky (HUV 18210!). Isoparatypus PREM.

Sori in floribus, flores tantum nonnullos paniculi eiusdem infecti, inconspicui, ab involucris floralibus externis cooperti, ovoidei, 1–1,5 x 1,5–2 mm, primo membrana brunnea origine nutricia cooperti, qua ab apice rupta massam brunneam, pulveream sporarum ostendentes. *Sporae* globosae, subglobosae usque ellipsoidales, 6–8(–9) x 6,5–9(–10) µm, pallide flavido-brunneae; pariete aequali, cca. 0,5 µm crasso, remote echinulato, lineam extremam sporae vix afficienti. In SEM superficies sporae inter spinas leniter verrucosa.

Sori (Fig. 1) in the flowers, only a few flowers in a panicle infected, inconspicuous, hidden by the outer floral envelopes, ovoid, 1–1.5 x 1.5–2 mm, first covered by a brown membrane of host origin which ruptures from its apex disclosing the brown, powdery mass of spores. *Spores* (Figs. 4, 5) globose, subglobose to ellipsoidal, 6–8(–9) x 6.5–9(–10) µm, pale yellowish-brown; wall even, c. 0.5 µm thick, sparsely echinulate which just affects the spore profile. In SEM, spore surface between the spines finely verruculose.

On *Enneapogon cenchroides* (Roem. & Schult.) C. E. Hubb.; S. Africa (Rep. of South Africa, Zimbabwe).

Key to the smut fungi of the tribe Pappophoreae.

1. Sori in the whole inflorescence 2
– Sori not so 3
2. Sori also comprise the basal part of the uppermost leaves. Spores 9.5–12 µm long. On *Enneapogon* and *Pappophorum* .... *Ustilago pappophori*
– Sori only in the inflorescence. Spores 10.5–13.5(–14.5) µm long. On *Enneapogon* .... *Ustilago enneapogonis*
3. Sori in all flowers of an inflorescence. Columella and sterile cells present. Spores 11–14 µm long. On *Enneapogon* .... *Sporisorium modestum*
– Sori in some of the flowers or ovaries of an inflorescence. Columella and sterile cells absent. Spores smaller 4
4. Sori in the ovaries. Spores 9–12 µm long. On *Schmidtia* .... *Ustilago schmidtiae*
– Sori in the flowers. Spores 6.5–9(–10) µm long. On *Enneapogon* ....
.... *Ustilago austro-africana*

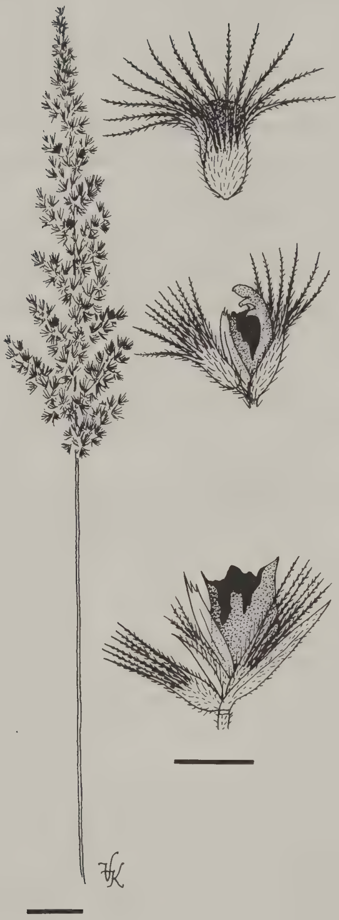

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Fig. 1. Sori of *Ustilago austro-africana* K. & C. Vánky in a few flowers of a panicle of *Enneapogon cenchroides* (Roem. & Schult.) C. E. Hubb. (type). Enlarged three sori more or less hidden by the floral envelopes.

Bars = 1 cm and 2 mm, respectively.

THE SMUT FUNGI OF *DIGITARIA* (GRAMINEAE)

Digitaria, with about 230 species in tropical and warm temperate regions, belongs to the subfamily Panicoideae, tribe Paniceae, subtribe Digitariinae (Clayton & Renvoize, 1986:298). Of the ten genera of Digitariinae, enumerated in Clayton & Renvoize, smut fungi have been reported only on *Digitaria*.

A comparative study of the smut fungi of *Digitaria* resulted in two new species (Vánky, 1999), and also in taxonomic and nomenclatorial synonyms. *Sphacelotheca digitariae-pedicellaris* J. N. Mishra, and *Ustilago belgiana* Zundel turned out to be synonyms of *U. syntherismae* (Schwein.) Peck. *Ustilago longiflora* Mundkur & Thirum. is identical with *U. royleani* H. & P. Sydow & Butler. The study of the type specimen of *Sphacelotheca linderi* Zundel revealed discrepancies between the spore measurements given by Zundel ("spores . . . . chiefly 4–7 µ in diameter") and those measured by me (6–9 x 6.5–11 µm). Consequently, *Sphacelotheca linderi* (= *Sporisorium linderi*) is identical with *Sorosporium inconspicuum* (Pole-Evans) Zundel (invalid name; validated under the name of *Sporisorium pole-evansii* K. Vánky, 1999:23). The *Tilletia* species on *Digitaria* are treated according to Durán & Fischer (1961). The recognised species are:

1. ***Ustilago syntherismae*** (Schweinitz) Peck, 1875:103.

Caeoma (Uredo) syntherismae Schweinitz, 1834:290. — *Sorosporium syntherismae* (Schw.) Farlow, in Farlow & Seymour, 1891:152. — Type on *Syntherisma* sp. [= *Digitaria* sp.], USA, Carolina.

Ustilago rabenhorstiana Kühn, 1876:4. — Type on *Panicum sanguinale* L. f. *sativa* [= *Digitaria sanguinalis* (L.) Scop.], Germany, Halle a./S., J. Kühn; isotypes in Rbh., Fgi. eur. 2099 (HUV 4755!).

Ustilago destruens Schlechtendal var. *digitariae* Saccardo, 1876:167. — Type on *Digitaria sanguinalis* (L.) Scop., Italy, Verona, Tregnago, IX.1874, C. Massalongo.

Ustilago digitariicola Spegazzini, 1902:57. — Type on *Digitaria sanguinalis* (L.) Scop., Argentina, La Plata, II.1902, C. Spegazzini.

Ustilago belgiana Zundel, 1944:401. — Lectotype on *Digitaria horizontalis* Willd., Belgian Congo [Zaire, Rep. of Congo], Kinshasa, 16.XII.1926, D. H. Linder, Flora of tropical Africa No. 1614 (BPI 157969!). For types see below.

Sphacelotheca digitariae-pedicellaris J. N. Mishra, 1957:259. — Type on *Digitaria pedicellaris* (Trin.) Prain (= *D. granularis* (Trin.) Henr.), India, Bihar, Nonihat, 29.VIII.1955, J. N. Mishra. Holotype in HCIO (25281), isotypes in IMI (68183) and in HUV (17282!).

Ustilago syntherismae is the most common smut fungus on *Digitaria* and the only one on this host genus known from Europe.

For its description and illustration see Vánky, 1994:380 & 439.

On *Digitaria adscendens* (H. B. K.) Henr., *D. bifasciculata* (Trin.) Henr., *D. ciliaris* (Retz.) Koehler, *D. cruciata* (Nees) A. Camus, *D. divaricatissima*

(R. Br.) Hughes, *D. filiformis* (L.) Koel., *D. granularis* (Trin.) Henr. (*D. pedicellaris* (Trin.) Prain), *D. horizontalis* Willd., *D. ischaemum* (Schreber) Muhl., *D. longiflora* (Retz.) Pers., *D. sanguinalis* (L.) Scop., *D. stricta* Roth ex Roem. & Schult., *D. ternata* (A. Rich.) Stapf ex Dyer; world-wide.

Zundel (1944:401) described ***Ustilago belgiana*** Zundel on *Digitaria horizontalis* Willd. from Belgian Congo, and on *D. ischaemum* (Schreber) Muhl. from China, without indicating a type. The study of the syntypes revealed that it is identical with the widely distributed *Ustilago syntherismae* (Schwein.) Peck (noticed also by J. Walker in some BPI specimens). Lectotype (designated here) on *Digitaria horizontalis* Willd., Belgian Congo [Zaire, Rep. of Congo], Kinshasa, 16.XII.1926, D. H. Linder, Flora of tropical Africa No. 1614 (BPI 157969!). Isolectotypes in BPI 157967!, 157970!. Syntypes on *Digitaria ischaemum* (Schreber) Muhl., China, Anhwei Prov., Chiu Hua Shan, Ch'ing Yang Hsien, Sha Kann, 24.X.1932, S. Y. Cheo No. 1393 (BPI 157966!, BPI 157968!), No. 1394 (BPI 157971!; HCIO 25243!, HUV 15406!), and No. 1395 (as on *Digitaria* sp., BPI 157965!).

2. *Sporisorium diplosporum* (Ellis & Everhart) K. Vánky, **comb. nov.**
Basionym: *Ustilago diplospora* Ellis & Everhart, J. Mycol. 6:119, 1891. — *Sphacelotheca diplospora* (Ellis & Ev.) G. P. Clinton, 1902:140. — Type on *Panicum sanguinale* L. (= *Digitaria sanguinalis* (L.) Scop., USA, Mississippi, Holly Springs, IX.1890, S. M. Tracy (1551).

Sori in some ovaries of an inflorescence, rather inconspicuous, showing between the spreading glumes which they rarely exceed in length, with a yellowish-brown peridium that soon ruptures and discloses an olivaceous-brown, dusty mass of spores intermixed with sterile cells around a short, central columella. *Spore balls* made up by many spores, loose, easily separating into single spores. *Spores* rounded subpolyhedral, rarely subglobose or ovoid, 7–9.5 x 8–11 µm, yellowish-brown; wall even, c. 0.5 µm thick, moderately densely, finely echinulate just affecting the spore profile which appears finely serrulate. *Sterile cells* 10–16 µm long, hyaline, single or usually in small groups, collapsed in old specimens.

On *Digitaria sanguinalis* (L.) Scop., *Echinochloa crus-galli* (L.) P. Beauv., and *E. holciformis* (H. B. K.) Chase; North America (USA, Mexico).

3. *Ustilago royleani* H. & P. Sydow & Butler, 1906:426.
Type on *Paspalum royleanum* Nees (= *Digitaria royleana* (Nees) Prain; = *D. stricta* Roth ex Roem. & Schult.), India, Uttar Pradesh, Dehra Dun, 10.X.1903, E. J. Butler (444; HCIO 444!). Isotypes in Indian Ustilaginales No. 45 (HUV 5792!).

Ustilago longiflora Mundkur & Thirum., in Thirumalachar & Mundkur, 1951:2. — Type on *Digitaria longiflora* (Retz.) Pers., India, Mysore State, Bangalore Distr., Lalbagh, 17.XI.1944, M. J. Thirumalachar (HCIO 10779!).

Sori in the rachis and/or in the spikelets as small pustules or, by confluence, long striae embedded in the host tissues. The epidermis on both sides of the sori soon ruptures disclosing the blackish-brown, powdery mass of spores which is dispersed leaving behind the perforated or shredded host tissues. *Spores* globose, subglobose, ellipsoidal or slightly subpolyhedrally irregular, (8–)9–12 x 10–13(–14.5) µm, yellowish-brown, echinulate; wall uniform, (1–)1.5–2 µm thick including the 0.5–1 µm high, rather sparsely situated spines.

On *Digitaria longiflora* (Retz.) Pers., and *D. stricta* Roth ex Roem. & Schult.; South Asia (India).

Comparison of the types of *Ustilago longiflora* and *U. royleani* did not reveal any difference in the sorus or spore morphology. Therefore, I consider them to be synonyms, despite the fact that in the original description of *U. longiflora* only sori in the "ovaries" are mentioned and the spore measurements "7.5 to 12.5 µ" are given.

4. ***Sporisorium dolichosorum*** (Ainsworth) K. Vánky, **comb. nov.**

Basionym: *Sphacelotheca dolichosora* Ainsworth, Proc. Linn. Soc. London 153(1):94, 1941. — Type on *Digitaria longiflora* (Retz.) Pers., Uganda, Entebbe, II.1930, L. C. C. Liebenberg, Herb. Dept. Agricult. Uganda No. 1078. Holotype in IMI 44763!

Sori destroying the whole inflorescence, cylindrical, slightly tapered at both ends, 1–2 mm wide, 4–11 cm long, first covered by a well-developed grey to grey-brown peridium which disintegrates from the apex to expose a dark brown, dusty spore mass and several (6 or more) filiform columellae. *Spore balls* subglobose, ellipsoidal to slightly irregular, 30–50 x 30–65 µm, reddish-brown, composed of 25–80 (or more?) easily separating spores. *Spores* rounded, subpolyhedrally irregular, more rarely subglobose or ovoid, 6.5–9 x 7–11 µm, yellowish-brown; wall uniform, c. 0.5 µm thick, finely, moderately densely punctate-verruculose which hardly affects the spore profile. *Sterile cells* few, 6–12 µm long, hyaline, arranged in rows.

On *Digitaria longiflora* (Retz.) Pers.; C. Africa (Uganda). Known only from the type collection.

5. ***Sporisorium linderi*** (Zundel) K. Vánky, **comb. nov.**

Basionym: *Sphacelotheca linderi* Zundel (as "*linderii*"; see ICBN Art. 60, Rec. 60C(b)), Mycologia 36:405, 1944. — Type on *Digitaria horizontalis* Willd., Belgian Congo [= Rep. of Congo], 2.XII.1936, D. H. Linder (1611). Holotype in BPI 195099!

Ustilago inconspicua Pole-Evans (nom. herb.). — *Sorosporium inconspicuum* (Pole-Evans) Zundel, 1938:304 (invalid name, no Latin diagnosis, ICBN 36.1). — On *Digitaria monodactyla* (Nees) Stapf, Rep. of South Africa, Pretoria, 26.XII.1915, leg. I. B. Pole-Evans (PREM 9416!); not *Sporisorium inconspicuum* (Zundel) K. Vánky, 1991:164, type on *Mesosetum loliiforme* (Hochst.) Chase, Brazil.

Sporisorium pole-evansii K. Vánky, 1999:23. — Type on *Digitaria eriantha* Steud., Rep. of South Africa, Gauteng Prov., c. 15 km S. of Pretoria, Irene Institute, alt. 1500 m, 15.I.1997, leg. C. Roux, C. & K. Vánky. Holotype in HUV (18452!), isotypes in PREM, BPI and in Vánky, Ustil. Exs. No. 1026. Paratype on *Digitaria monodactyla* (Nees) Stapf, Rep. of South Africa, KwaZulu-Natal Prov., Drakensberg Mts., Cathedral Peak National Park, Mikes Pass, alt. c. 2000 m, 30.XII.1996, leg. C. & K. Vánky. Holoparatype in HUV (18453!), isoparatypes in PREM and in BPI.

For description and illustration see Vánky, 1999:23, under the name of *Sporisorium pole-evansii*.

On *Digitaria argyrograpta* Stapf, *D. eriantha* Steud., *D. horizontalis* Willd., *D. monodactyla* (Nees) Stapf, *D. penzii* Stent, and *D.* sp.; C. and S. Africa (Malawi, Rep. of Congo, Rep. of South Africa).

6. *Ustilago drakensbergiana* K. Vánky, 1999:24.

Type on *Digitaria tricholaenoides* Stapf, Rep. of South Africa, KwaZulu-Natal Prov., Drakensberg Mts., Cobham Nature Reserve, near the Camp site, alt. 1620 m, 7.I.1997, leg. C. & K. Vánky. Holotype in HUV (18456!), isotypes in PREM and in Vánky, Ustil. Exs. No. 1046.

For description and illustration see Vánky, 1999:24.

On *Digitaria tricholaenoides* Stapf; S. Africa (Rep. of South Africa). Known only from the type collection on this endemic host plant.

According to Durán and Fischer (1961:23), the following three *Tilletia* species are known on *Digitaria*,: 1. ***T. barclayana*** (Brefeld) Saccardo & P. Sydow, in Saccardo, 1899:422 (type on *Pennisetum triflorum* Nees, India), including *T. pulcherrima* Ellis & Galloway ex G. P. Clinton, 1904:441 (type on *Panicum virgatum* L., USA), 2. ***T. maclagani*** (Berkeley) G. P. Clinton, 1902:148 (type on *Panicum virgatum* L., Canada), and 3. ***T. setariae*** L. Ling, 1945:2 (type on *Setaria lutescens* (Weigel) F. T. Hubb., China), including *T. digitariicola* M. S. Pavgi & Thirum, in Thirumalachar & Pavgi, 1952:393 (type on *Digitaria royleana* Prain, India). For descriptions and illustrations see Durán & Fischer, 1961.

I discussed (Vánky, 1990:477) ***Ustilago digitariae*** auctt., and concluded that it is not known what the name *Uredo* (*Ustilago*) *digitariae* Kuntze (in Holl, 1830:369) represents. The type was described on "*Digitaria setigera* Rth." from the Island of Madeira. The host plant is apparently a misidentification because it does not occur in Madeira. Furthermore, I found that *Uredo digitariae* Rabenhorst (Herb. viv. myc., ed. 2, No. 1199, 1847) is *Ustilago cynodontis* (Henn.) Henn. on *Cynodon dactylon* (L.) Pers.

Key to the smut fungi of *Digitaria*.

1. Sori in the ovaries 5
– Sori comprise more than the ovaries 2
2. Sori in the rachis and/or in the spikelets, pustular .... *Ustilago royleani*
– Sori in the racemes or in the whole inflorescence, not pustular 3
3. Sori in the racemes. Spores 5–6.5(–7) µm long .... *U. drakensbergiana*
– Sori in the whole inflorescence. Spores larger 4
4. Spores 7–11 µm long, punctate-verruculose .... *Sporisorium dolichosorum*
– Spores 10–15 µm long, echinulate .... *Ustilago syntherismae*
5. Spores 7–11 µm long 6
– Spores 14–29 µm long or longer 7
6. Sori in some of the ovaries. Spores finely echinulate .... *Sporisorium diplosporum*
– Sori in all ovaries. Spores verruculose .... *Sporisorium linderi*
7. Spores with sharp, pointed or curved spines .... *Tilletia barclayana*
– Spores sculptured otherwise 8
8. Spores finely verrucose; exospore 2.5–3.5 µm thick .... *Tilletia maclagani*
– Spores with truncate scale-like projections; exospore 1.5–2.5 µm thick .... *Tilletia setariae*

TWO NEW SMUT FUNGI OF *DACTYLOCTENIUM* (GRAMINEAE)

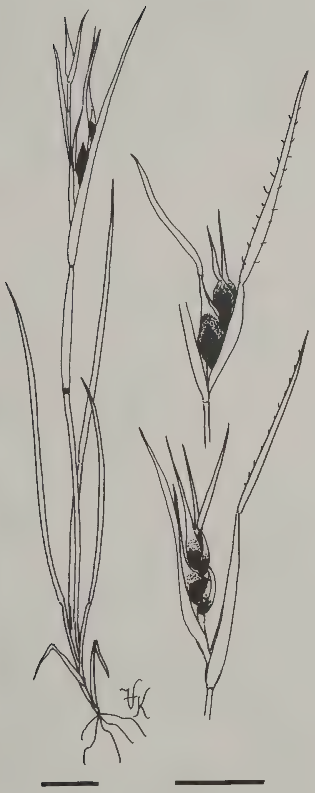
I studied the smut fungi of *Dactyloctenium* (Vánky, 1995:232-233; 1996:94-95) and recognised seven species. Revising Australian and Indian smut fungi, two further undescribed species were found, one on the distal part of the shoots of *D. radulans* (R. Br.) P. Beauv., the other one producing vivipary-like hypertrophy in the spikelets of *D. aegyptium* (L.) P. Beauv.

Ustilago radulans K. Vánky, **sp. nov.**

Typus in matrice *Dactyloctenium radulans* (R. Br.) P. Beauv., Australia, Queensland, Townsville, 19°13' S, 146°48' E, 23.III.1935, leg. S. T. Blake. Holotypus in BRIP 7889!, isotypi in HUV 18636! et in IMI 42903!

Sori in parte distali surculorum, partem basalem vaginae folii ad diametrum millimetrorum nonnullorum inflatam destruentes. Sori etiam axem principalem surculi occupantes foliis condensatis partim absconditi, primo membrana tenui, cinerea, origine matricali cooperti, qua irregulariter rupta massas pulvereas, atro-chocolatabrunneas sporarum ostendentes. *Sporae* globosae, subglobosae, late ellipsoidales, ovoideae, 9,5–14 x 10–14,5(–15) µm, flavido-brunneae, evidenter echinulatae; pariete aequali, cca. 1,5 µm crasso, spinis cca. 1 µm altis inclusis.

Sori (Fig. 2) in the distal part of the shoots destroying the basal part of the leaf sheaths which swell to a few mm in diameter. The sori also comprise the main axis of the shoot, partly hidden by the congested leaves, first covered by a thin, grey membrane of host origin which ruptures irregularly disclosing the powdery, dark chocolate-brown spore masses. *Spores* (Figs. 6, 7) globose, subglobose,



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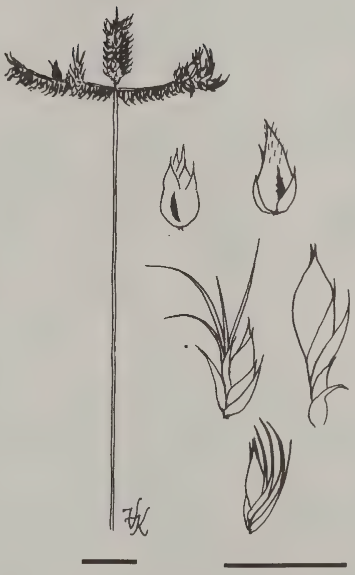

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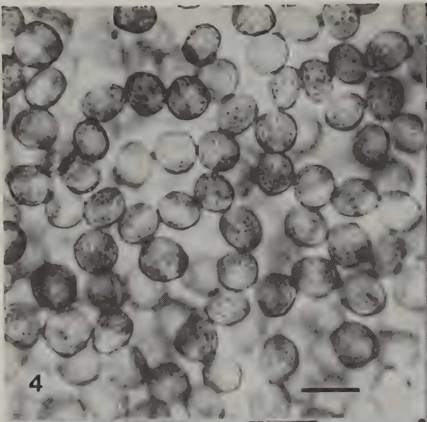
Fig. 2. Sori of *Ustilago radulans* K. Vánky in the leaf-sheaths and distal part of the shoots of *Dactyloctenium radulans* (R. Br.) P. Beauv. (type). Bars = 1 cm.

Fig. 3. Sori of *Ustilago viviparifera* K. & C. Vánky & N. D. Sharma in some of the spikelets of *Dactyloctenium aegyptium* (L.) P. Beauv., often producing vivipary-like hypertrophy (type). Bars = 1 cm.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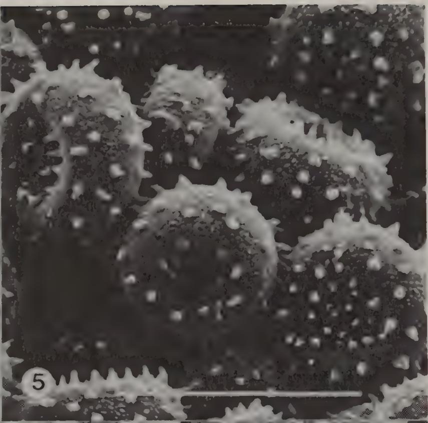
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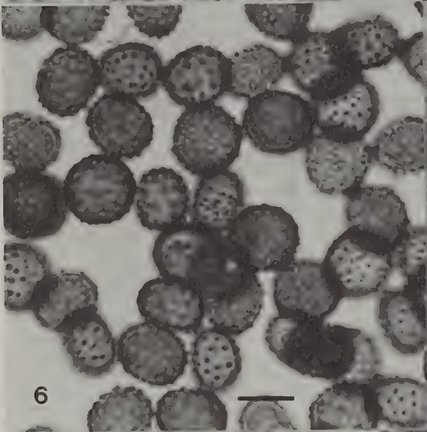
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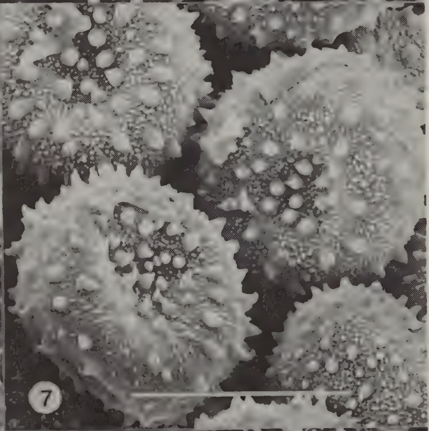
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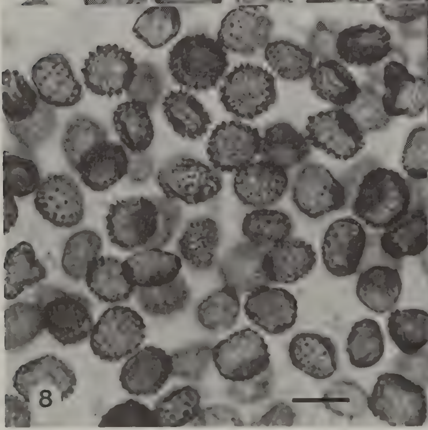
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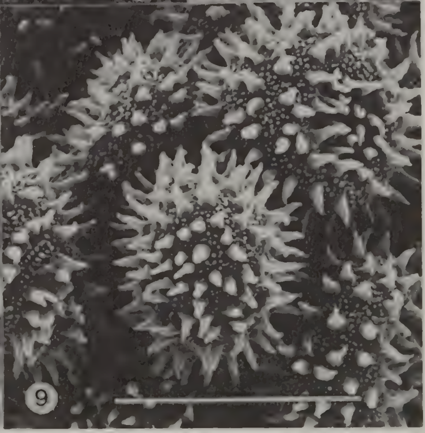
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broadly ellipsoidal, ovoid, 9.5–14 x 10–14.5(–15) µm, yellowish-brown, evidently echinulate; wall uniform, c. 1.5 µm thick, including the c. 1 µm high spines.

On the endemic *Dactyloctenium radulans* (R. Br.) P. Beauv., in several places in Australia.

The sori of *U. radulans* resemble those of *U. idonea* H. Sydow (type on *D. sindicum*), and those of *U. dactyloctenii* Henn. (type on *D. aegyptium*). However, the spores of *U. idonea* are smaller (8–11 µm long) and only finely echinulate. The spores of *U. dactyloctenii* are very finely, densely punctate.

Ustilago viviparifera K. & C. Vánky & N. D. Sharma, **sp. nov.**

Typus in matrice *Dactyloctenium aegyptium* (L.) P. Beauv., India, Karnataka, Uttar Kannad Distr., c. 30 km S Karwar, pr. pag. Ankola, 14°38' N, 74°20' E, alt. c. 15 m. s. m., 28.X.1995, leg. N. D. Sharma, R. Berndt, C. & K. Vánky. Holotypus in Herbario Ustil. Vánky (HUV 17518), isotypi in BPI et in HCIO.

Sori in spiculis nonnullis inflorescentiae eiusdem, 1–1,5 x 1,5–3 mm, solitares vel plerumque in gregibus nonnullis. Sori singuli ovoidei cum apice acuto e rudimentis involucrorum floralium eos cooperientium in numero et statu progressionis differentium. Casu extremo illa filiformia, soros plus-minus cooperientia vel etiam surculos soros sustinentes formantia, aspectum vivipariae praebentes. Maturitate sori irregulariter discissi massam agglutinatam usque semipulveream, atro-brunneam sporarum ostendentes. Sine columella, sine cellulis sterilibus. *Sporae* ovoideae, ellipsoidales vel irregulares, rarius globosae vel subglobosae, 7–11 x 8–12 µm, flavidobrunneae, prominenter echinulatae; pariete aequali, cca. 1,5 µm crasso, spinis cca. 1 µm altis inclusis. In SEM superficies inter spinas leniter, dense verruculosa.

Sori (Fig. 3) in some of the spikelets of an inflorescence, 1–1.5 x 1.5–3 mm, solitary or usually several in groups. Single sori ovoid with acute tip formed by rudiments of floral envelopes which cover the sori in different number and developmental stage. In extreme cases these are leaf-like, more or less covering the sori or even forming shoots which subtend the sori, giving an aspect of vivipary. At maturity, the sori burst irregularly disclosing the agglutinated to

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Figs. 4, 5. Spores of *Ustilago austro-africana* K. & C. Vánky on *Enneapogon cenchroides* (Roem. & Schult.) C. E. Hubb., in light microscope (LM) and in scanning electron microscope (SEM; type).

Figs. 6, 7. Spores of *Ustilago radulans* K. Vánky on *Dactyloctenium radulans* (R. Br.) P. Beauv., in LM and in SEM (type).

Figs. 8, 9. Spores of *Ustilago viviparifera* K. & C. Vánky & N. D. Sharma, on *Dactyloctenium aegyptium* (L.) P. Beauv., in LM and in SEM (type).

Bars = 10 µm.

semipowdery, dark brown mass of spores. No columella, no sterile cells. *Spores* (Figs. 8, 9) ovoid, ellipsoidal or irregular, more rarely globose or subglobose, 7–11 x 8–12 µm, yellowish-brown, prominently echinulate; wall uniform, c. 1.5 µm thick, including the c. 1 µm high spines. In SEM the surface between the spines is finely, densely verruculose.

On *Dactyloctenium aegyptium* (L.) P. Beauv.; S. Asia (India). Known only from the type collection.

Ustilago dactylocteniophila Henn. develops its sori in the spikelets of *Dactyloctenium* but without producing vivipary-like hypertrophy in the inflorescence. The spores of *U. dactylocteniophila* are somewhat larger (9–14 µm long) than those in *U. viviparifera*, and are very finely, sparsely, punctate-echinulate.

The nine recognised species of Ustilaginales on *Dactyloctenium* are: **1**. *Tilletia dactyloctenii* K. Vánky (type on *D. aegyptium* (L.) P. Beauv., India), **2**. *T. eleusines* H. Sydow (type on *D. aegyptium*, India), **3**. *Ustilago ctenioides* K. Vánky (type on *D. ctenioides* (Steudel) Bosser, Island of Reunion), **4**. *U. dactyloctenii* Henn. (type on *D. aegyptium*, Zanzibar), **5**. *U. dactylocteniophila* Henn. (type on *D. aegyptium*, Brazil), **6**. *U. idonea* H. Sydow (type on *D. sindicum* Boiss., India), **7**. *U. radulans* K. Vánky (type on *D. radulans* (R. Br.) P. Beauv., Australia), **8**. *U. sparsa* Underwood (type on *D. aegyptium*, USA), and **9**. *U. viviparifera* K. Vánky (type on *D. aegyptium*, India).

Key to the smut fungi of *Dactyloctenium*.

1. Spores more than 15 µm long 2
– Spores less than 15 µm long 3
2. Spores echinulate-reticulate, muri weak .... *T. dactyloctenii*
– Spores reticulate, muri well-developed .... *T. eleusines*
3. Sori in the distal part of the shoots 4
– Sori in the spikelets or in the ovaries 6
4. Spores (7–)8–11 µm long, finely, moderately densely echinulate .... *U. idonea*
– Spores c. 10–14 µm long 5
5. Spores very finely, densely punctate .... *U. dactyloctenii*
– Spores sparsely, evidently echinulate .... *U. radulans*
6. Sori in the spikelets 7
– Sori in the ovaries 8
7. The fungus produces vivipary-like hypertrophy of host spikelets. Spores 8–12 µm long, prominently echinulate .... *U. viviparifera*
– The fungus not produces vivipary-like hypertrophy of host spikelets. Spores 9–14 µm long, finely, sparsely punctate-echinulate .... *U. dactylocteniophila*
8. Spores 9–13 µm long, coarsely verrucose-echinulate .... *U. ctenioides*
– Spores 6–10 µm long, finely, sparsely punctate-verruculose .... *U. sparsa*

A NEW *USTILAGO* ON *LEPTURUS* (GRAMINEAE)

Lepturus R. Br. is a small genus of c. 8 species in Old World tropics, belonging to the subfamily Chloridoideae, tribe Eragrostideae, subtribe Leptureae (Clayton & Renvoize, 1986). The systematic position of grasses with an apparently similar raceme was subject to many generic changes as seen from the number of synonyms in the genera *Hainardia*, *Hemarthria*, *Lepturus*, *Manisuris*, *Monerma*, *Parapholis*, *Pholiurus*, *Rottboellia*. The smut fungi on these genara have been studied (Vánky, 1991:162-164). The host plants of the smut fungi described on "*Lepturus*" species are actually *Hemarthria*, *Parapholis* or *Pholiurus*. A new and first smut fungus on a true *Lepturus* is:

Ustilago lepturi-xerophili K. Vánky, **sp. nov.**

Typus in matrice *Lepturus xerophilus* Domin, Australia, Queensland, Chillagoe, 17°07' S, 144°32' E, 29.III.1938, leg. S. T. Blake (13514A). Holotypus in BRIP 8095!, isotypus in HUV 18638!

Sori in ovariis, omnia in racemo inficientes, ovoidei, cca. 0,8 x 1,5 mm, involucris floralibus plus-minus obtecti, primo membrana tenui, cinerea, origine matricali cooperti, qua irrgulariter rupta, massam atrobrunneam, semi-pulveream sporarum ostendentes. *Sporae* satis variabiles, subglobosae, ovoideae, late ellipsoidales, elongatae usque irregulares, 7–10,5 x 8–12(–13) μm, flavido-brunneae; pariete aequali, cca. 0,5 μm crasso, modice dense punctato-echinulato, lineam extremam sporae vix efficienter.

Sori (Fig. 10) in all ovaries of the raceme, ovoid, c. 0.8 x 1.5 mm, more or less hidden by the floral envelopes, first covered by a thin, greyish membrane of host origin which ruptures irrgularly disclosing the dark brown, semi-powdery mass of spores. *Spores* (Figs. 15, 16) rather variable, subglobose, ovoid, broadly ellipsoidal, elongate to irregular, 7–10.5 x 8–12(–13) μm, yellowish-brown; wall even, c. 0.5 μm thick, moderately densely punctate-echinulate which just affects the spore profile.

Key to the smut fungi of grass genera mentioned above.

1. Sori in the ovaries 2
– Sori not in the ovaries 3
2. Spores reticulate, 21–25 μm long .... *Tilletia lepturi*
– Spores punctate-echinulate, 8–13 μm long .... *Ustilago lepturi-xerophili*
3. Sori in the spikelets. Spores verrucose, 12–17 μm long .... *Ustilago monermae*
– Sori in the whole inflorescence, whip-like 4
4. Spores echinulate, 9.5–12 μm long .... *Sporisorium erythraeense*
– Spores apparently smooth to minutely echinulate 5
5. Spores 9–14 μm long .... *Sporisorium ophiuri*
– Spores smaller 6
6. Spores 3–6 μm long .... *Ustilago parasnathii*
– Spores larger 7
7. Spores 5.5–8 μm long .... *Sporisorium cornutum*
– Spores 6–9(–10) μm long .... *Sporisorium lepturi*

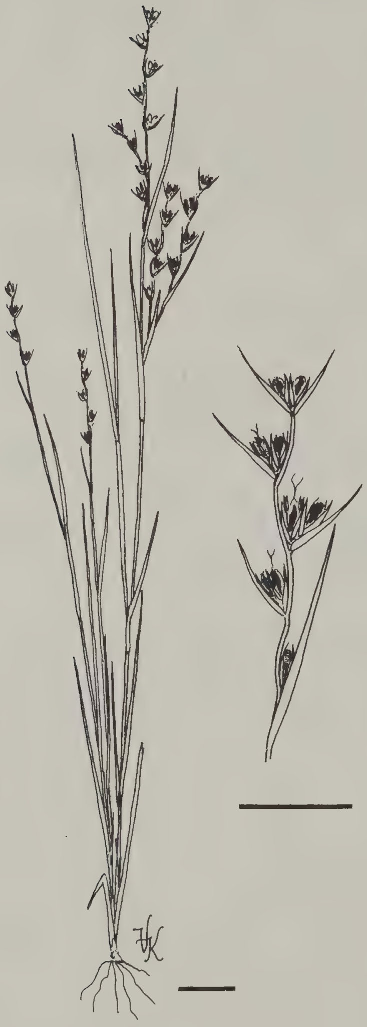

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Fig. 10. Sori of *Ustilago lepturi-xerophili* K. Vánky in all ovaries of *Lepturus xerophilus* Domin (type). Bars = 1 cm.

A NEW *SPORISORIUM* ON *ISEILEMA* (GRAMINEAE)

The c. 20 species of *Iseilema* Anderss. (subfamily Panicoideae, tribe Andropogoneae, subtribe Anthistiriinae) are distributed from India to Australia (Clayton & Renvoize, 1986). I studied the smut fungi of *Iseilema* (Vánky, 1996:104-106, 1997b:151, 1998:337-341) and recognised six *Sporisorium* species: one on *I. ciliatum* C. E. Hubb. from Australia [*S. iseilematis-ciliati* K. Vánky], one on *I. mitchellii* Anderss., also from Australia [*S. mitchellii* (H. & P. Sydow) K. Vánky], three on *I. laxum* Hackel from India [*S. iseilematis* (H. & P. Sydow & Butler) K. Vánky, *S. inayati* (H. & P. Sydow & Butler) K. Vánky, and *S. thirumalacharii* K. Vánky], and one on *I. prostratum* (L.) Anderss., also from India [*S. iseilematis-prostrati* K. Vánky]. Recently, a different species of *Sporisorium* was collected on *I. vaginiflorum* in Australia, which is described as

Sporisorium iseilematis-vaginiflori K. Vánky, **sp. nov.**

Typus in matrice *Iseilema vaginiflorum* Domin, Australia, Qeensland, 18 km E Cunnamulla, 28°03'21" N, 145°51'15" E, alt. cca. 230 m, 11.III.1998, leg. C. & K. Vánky. Holotypus in Herbario Ustil. Vánky (HUV 18529), isotypi in BPI, BRIP et in Vánky, Ust. exs. No. 1022.

Sori racemos occupantes, cylindrici, 1–1,5 x 3–6 mm, primo peridio crasso, pallide brunneo cooperti, quo mature dehiscenti massam sporarum nigrescenti-brunneam, pulverulentem, cellulis sterilibus intermixtam et columellam centralem, simplicem, 3–6 mm altam ostendentes. *Glomeruli sporarum* multispori, laxi, mature in sporis singulis dissoluti. *Sporae* parum subpolyedriciter irregulares, rarius subglobosae, ellipsoidales vel elongatae, 9,5–13 x 10,5–16(–17,5) µm, rubescenti-brunneae; pariete aequali vel parum inaequali, 0,5–1 µm crasso, leniter, dense, echinulato. *Cellulae steriles* in gregibus irregularibus, cellulae singulae globosae, ovoideae usque irregulares, latere uno vel lateribus nonnullis deplanatae, plerumque sporis minores, 6–13 x (6–)7–15 µm, cellulae globosae diametro 6–12 µm, subhyalinae usque pallide flavido-brunneae; pariete 0,5–1,5 µm crasso, levi. *Germinatio sporarum* (in agaro aquoso, temperatura in conclavis solita, in 2–3 diebus) cum tubo simplici, aseptato, 2,5–3 µm crasso. Hic usque ad 110–130 µm elongatus parte apicali protoplasmate impleta, tubum longum vacuum relinquenti. Neque formatio parietem transversalium neque basidiosporarum observata.

Sori (Fig. 11) comprising the racemes, cylindrical, 1–1.5 x 3–6 mm, first covered by a thick, pale brown peridium which early dehisces disclosing a blackish-brown, powdery mass of spores intermixed with sterile cells, surrounding a simple, 3–6 mm long central columella. *Spore balls* (Fig. 17) many-spored, loose, early separating into single spores. *Spores* (Figs. 17, 18) slightly subpolyhedrally irregular, more rarely subglobose, ellipsoidal or elongated, 9.5–13 x 10.5–16(–17.5) µm, reddish-brown; wall even to slightly uneven, 0.5–1 µm thick, finely, densely echinulate. *Sterile cells* (Figs. 17, 18) in irregular groups, single cells globose, ovoid to irregular, with one or several

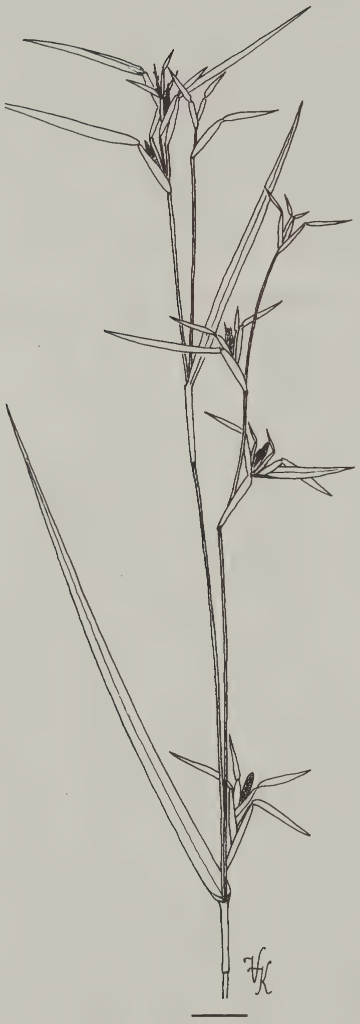

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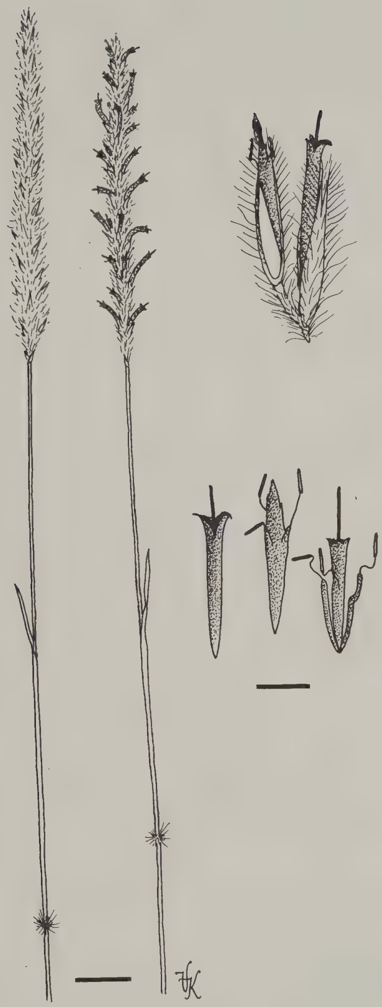
Fig. 11. Sori of *Sporisorium iseilematis-vaginiflori* K. Vánky in the racemes of *Iseilema vaginiflorum* Domin (type). Bar = 1 cm.



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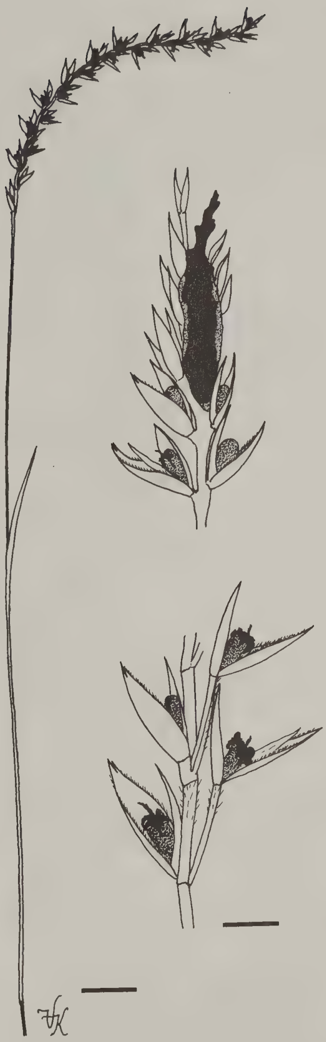

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Fig. 12. Sori of *Sporisorium elionuri* (Henn. & Pole-Evans) K. Vánky on *Elionurus muticus* (Spreng.) Kunth, South Africa (HUV 18416). Enlarged a paired-spikelet in which the inner floral parts of both sessile, hermaphrodite spikelet and the pedicelled, male spikelet are tranformed into sori. In two of the three isolated sori, infected filaments can be seen which are more or less fused with the main, central sorus, or they are free. Bars = 1 cm and 3 mm.

Fig. 13. Sori of *Sporisorium elionuri-tristis* K. Vánky on *Elionurus tristis* Hack. (type). Enlarged two pairs of spikelets with sori and also the distal part of a raceme more or less destroyed. Bars = 1 cm and 2 mm, respectively.

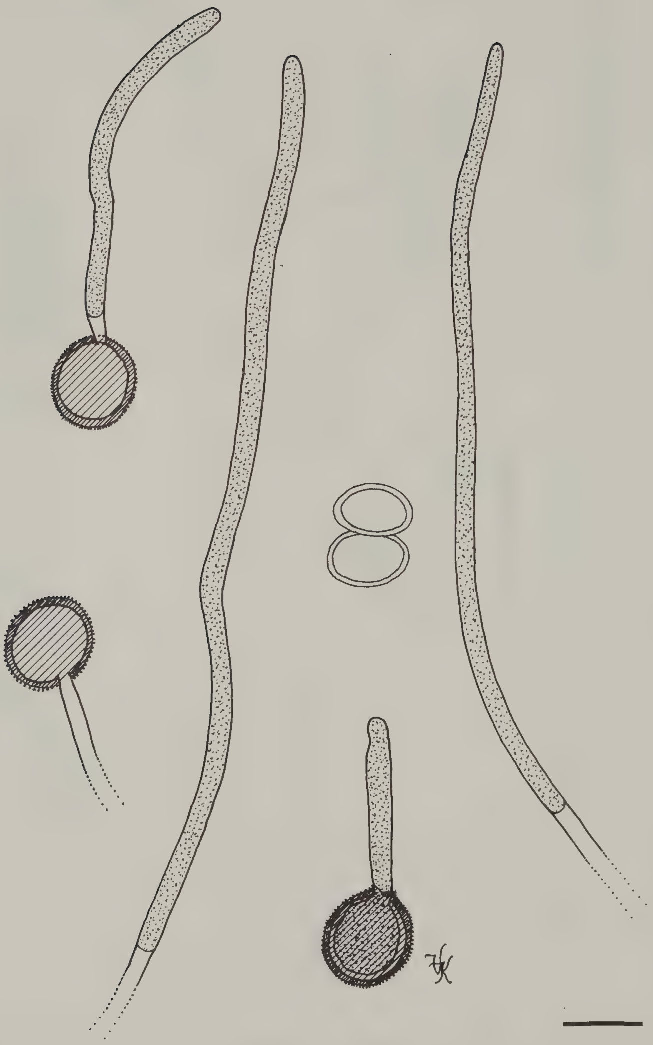

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Fig. 14. Germinating spores and two sterile cells of *Sporisorium iseilematis-vaginiflori* K. Vánky (type). On water-agar with Tetracycline, at room temp., in 2-3 days, long, simple, unseptate, 2.5–3 µm wide germ tubes resulted. These prolongated into a 110–130 µm long apical part filled with protoplasm, leaving behind a long, empty tube. No formation of transversal walls or building of basidiospores could be observed. Bar = 10 µm.

flattened sides, usually smaller than the spores, 6–13 x (6–)7–15 µm, globose cells 6–12 µm in diameter, subhyaline to pale yellowish-brown; wall 0.5–1.5 µm thick, smooth. *Spore germination* (Fig. 14; on water-agar with Tetracycline, at room temp., in 2–3 days) resulted in a long, simple, unseptate, 2.5–3 µm wide germ tube. This elongated into a 110–130 µm long apical part filled with protoplasm, leaving behind a long, empty tube. No formation of transversal walls or of basidiospores could be observed.

On *Iseilema vaginiflorum* Domin; Australia. Known only from the type collection.

The sori of *Sporisorium iseilematis-vaginiflori* are similar to those of *S. iseilematis*, *S. iseilematis-prostrati* and *S. mitchellii*, but the spore measurements differenciate these four species (see the key).

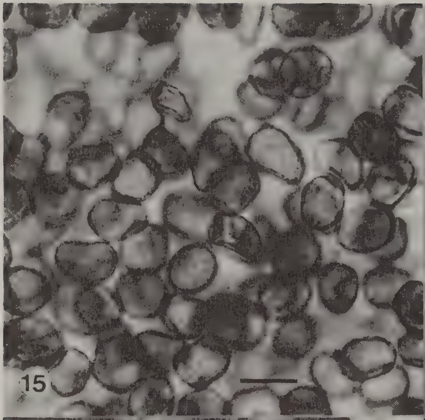
Key to the smut fungi of *Iseilema*.

1. The fungus produces witches' brooms 2
– The fungus does not produce witches' brooms 3
2. Sori 10–15 mm long, spore balls semi-permanent, dimorphic (i.e. outer and inner spores different).. *S. thirumalacharii*
– Sori 3–6 mm long, spore balls ephemeral, not dimorphic.... *S. iseilematis-ciliati*
3. Sori in the spikelets of some racemes of an inflorescence .... *S. inayati*
– Sori in all racemes of an inflorescence...4
4. Spores 5.5–7(–8) µm long, sparsely, finely verrucose.... *S. iseilematis-prostrati*
– Spores larger, echinulate..5
5. Spores 7–10 µm long.. *S. iseilematis*
– Spores larger..6
6. Spores 9–13.5 µm long.. *S. mitchellii*
– Spores 10.5–16(–17.5) µm long................................. *S. iseilematis-vaginiflori*

THE SMUT FUNGI OF *ELIONURUS* (GRAMINEAE)

Elionurus Kunth ex Willd. belongs to the subfamily Panicoideae, tribe Andropogoneae, subtribe Rottboelliinae. It is a fairly homogenous genus with 15 species in tropical Africa and America, and one species in Australia (Clayton & Renvoize, 1986). Several names of smut fungi on *Elionurus* have been published. All of the host plant names represent the same species, *E. muticus* (Sprengel) Kunth, and all smut fungus names represent the same species:

Sporisorium elionuri (Hennings & Pole-Evans) K. Vánky, **comb. nov.**
Basionym: *Ustilago elionuri* Henn. & Pole-Evans, in Hennings, Bot. Jahresb. Syst. 41:270, 1908. — *Sphacelotheca elionuri* (Henn. & Pole-Evans) Viennot-Bourgin (nom. herb.?). — Type on *Elionurus argenteus* Nees (= *E. muticus* (Sprengel) Kunth, Rep. of South Africa, Pretoria, XII.1905, I. B. Pole-Evans (PREM 102!).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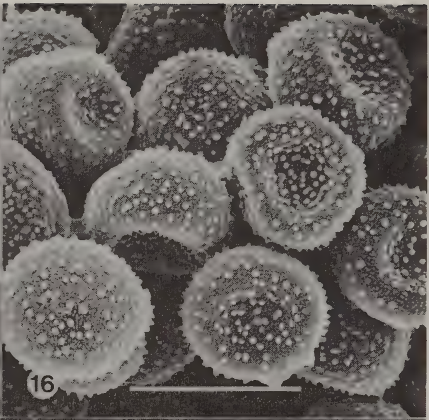
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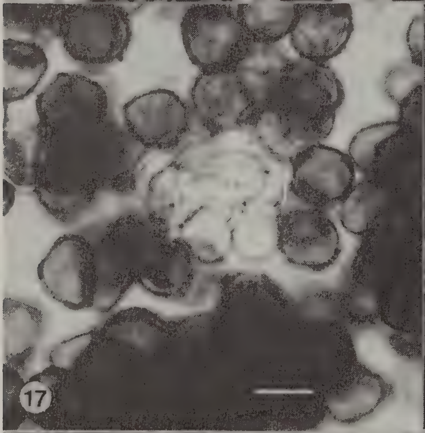
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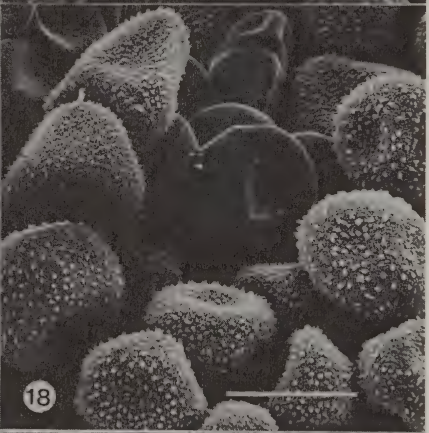
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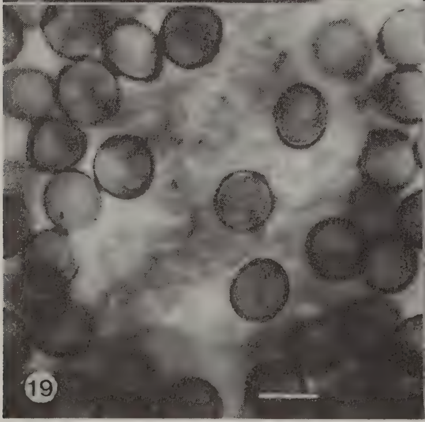
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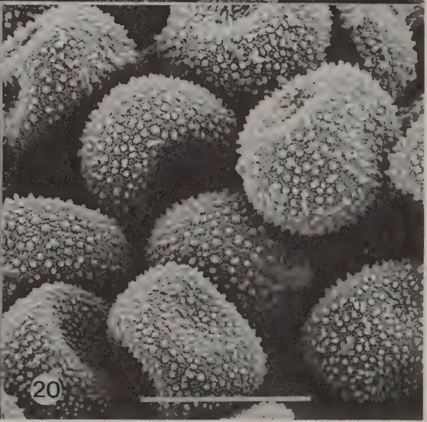
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Ustilago elionuri Spegazzini, 1909:288 (later homonym, not Henn. & Pole-Evans, 1908). — *Ustilago elionuri-candidi* Spegazzini, in Saccardo & Trotter, in Saccardo, 1912:501 (nom. nov. pro *U. elionuri* Speg.). — *Sphacelotheca elionuri-candidi* (Speg.) Hirschhorn, 1986:119. — Typus on *Elionurus candidus* (Trin.) Hackel (= *E. muticus* (Sprengel) Kunth), Argentina, Santa Fé Prov., near Reconquista, XI.1907, M. Estrada. Topotype: II.1908, C. Spegazzini (LPS 3106), isotopotype in BPI (160352!).

Sori (Fig. 12) in the inner floral parts, long-cylindrical, 0.7–1 x 5–10 mm, covered by a thin, greyish-brown peridium which ruptures from its apex disclosing the dark brown, semiagglutinated to powdery mass of spores and a simple, thin, central columella of the length of the sorus. The sori are ripening from their apex, where the spore mass becomes powdery and partly dispersed, whereas at the proximal part of the sori the spore mass is still agglutinated and the spores are immature. *Spores* subglobose, ovoid, ellipsoidal to slightly irregular, 5.5–8 x 6.5–9.5(–10.5) µm, olivaceous-brown; wall even, c. 1 µm tick, densely, uniformly, finely to coarsely low verruculose, the spore profile wavy or finely serrulate. *Sterile cells* between the spores are lacking, and spore balls could not be observed.

On *Elionurus muticus* (Sprengel) Kunth (*E. argenteus* Nees; *E. candidus* (Trin.) Hackel); Africa, S. America.

The sori of this species were originally described as being located in the ovaries. However, usually both the sessile, hermaphrodite spikelet as well as the pedicelled, male spikelet of the paired spikelets develop sori (Fig. 12). The young sori are often composed of a central, thicker, cylindrical part, and of thinner, swollen filaments which are either free or are more or less completely fused with the central part. These filaments are also filled with spores and bear aborted anthers. Even these sori, developed from the filaments, if they are free, have a flagelliform, central columella.

Some of the characters of the genus *Sporisorium* (e.g. the presence of sterile cells and of spore balls) are lacking in *S. elionuri*. However, based on the presence of a peridium and a columella, and the basipetal ripening of the sori, I consider this fungus to be a species of the rather variable (and certainly heterogenous) *Sporisorium* and not a *Ustilago*.

Figs. 15, 16. Spores of *Ustilago lepturi-xerophili* K. Vánky on *Lepturus xerophilus* Domin, in LM and in SEM (type).

Figs. 17, 18. Spore balls, spores and sterile cells of *Sporisorium iseilematis-vaginiflori* K. Vánky on *Iseilema vaginiflorum* Domin, in LM and in SEM (type).

Figs. 19, 20. Spores of *Sporisorium elionuri-tristis* K. Vánky on *Elionurus tristis* Hack., in LM and in SEM (type). Bars = 10 µm.

Amongst specimens obtained in exchange from PC, there was a smut fungus on *Elionurus tristis* Hack., under the name of *Sphacelotheca elionuri* (Henn. & Pole-Evans) Viennot-Bourgin (nom. herb.?), which represents a different species:

Sporisorium elionuri-tristis K. Vánky, **sp. nov.**

Typus in matrice *Elionurus tristis* Hack., Madagascar, ad meridiem Ambositra, 20°31' S, 47°15' E, I.1964, leg. J. Bosser (17715). Holotypus in Herbario Ustil. Vánky (HUV 16851!), isotypus in PC.

Sori in spiculis et in sessilibus et in pedicellatis, ovoidei usque breviter cylindrici, 0,7–1 x 1,5–2,5 mm, glumis distantibus protecti, primo peridio brunnea coopereti, quo ab apice rupto massam sporarum atrobrunneam, pulveream et gregem cellularum sterilium columellam brevem, simplicem, centralem circumdantem ostendentes. Sori forte partem spiculae vel illam totaliter occupantes, usque ad axem inflorescentiae (racemi) extendentes. *Sporae* maturae singulae, regulares, globosae, subglobosae usque late ellipsoidales, 9,5–12 x 10–13 µm, flavido brunneae; pariete aequali, cca. 1 µm crasso, modice dense, uniformiter, leniter echinulato, lineam extremam sporae vix afficienti. *Cellulae steriles* in gregibus irregularibus, in speciminibus vetustis collapsae, cellulae singulae 7–13 µm longae, hyalinae, contento homogeneo; pariete tenui (cca. 0.5 µm), levi.

Sori (Fig. 13) in both sessile and pedicelled spikelets, ovoid to short cylindrical, 0.7–1 x 1.5–2.5 mm, protected by the spreading glumes, first covered by a brown peridium which ruptures from its apex disclosing the dark-brown, powdery mass of spores and groups of sterile cells surrounding a short, simple, central columella. Sori may also comprise part of or the whole spikelet, extending to the inflorescence (raceme) axis. *Spores* (Figs. 19, 20) single when mature, regular, globose, subglobose to broadly ellipsoidal, 9.5–12 x 10–13 µm, yellowish-brown; wall even, c. 1 µm thick, moderately densely, uniformly, finely echinulate which just affects the spore profile. *Sterile cells* in irregular groups, collapsed in old specimen, single cells 7–13 µm long, hyaline, with homogenous content, wall thin (c. 0.5 µm), smooth.

On *Elionurus tristis* Hack.; S. Africa (Madagascar). Known only from the type collection.

Key to the smut fungi of *Elionurus*.

- Sori 5–10 mm long. Spores 6.5–9.5(–10.5) µm long .... *Sporisorium elionuri*
- Sori 1.5–2.5 mm long. Spores 10–13 µm long .... *Sporisorium elionuri-tristis*

NEW COMBINATION

Farysia caricis-petitianae (Zundel) K. Vánky, **comb. nov.**

Basionym: *Sphacelotheca caricis-petitianae* Zundel, Mycologia, 36:404, 1944. — Type on *Carex petitiana* A. Rich. (det. H. K. Svenson, 1939), Belgian Congo [= Republic of Congo], 1926-1927, coll. Bequaert. Holotype in BPI 177300!, isotypes in BPI 177302 & 195095 (ex Phanerogamic Herbarium, Flora of isotypes in BPI 177302 & 195095 (ex Phanerogamic Herbarium, Flora of Tropical Africa, Expedition of the Harvard Institute of Tropical Biology and Medicine, 1926-1927).

Sori in some of the ovaries, short-cylindrical, narrowing toward their basal part, 1–1.5 x 2–3 mm, covered by a thin, greyish, fungal membrane which ruptures on its apex to disclose the powdery, olivaceous-brown mass of spores intermixed with fascicles of sterile hyphae. *Spores* variable in form and size, globose, short to long subcylindrical or cylindrical, less frequently curved, pyriform or irregular, 3.5–9 x 4–13 μm, light olivaceous-brown; wall even, 0.5–1 μm thick, densely, uniformly verruculose, spore profile finely wavy or serrulate. Young spores, towards the basal part of the sorus, are catenate. The sorus membrane is formed of small, hyaline, agglutinated, fungal cells with thick, gelatinised wall.

The fungus shows all characters of the genus *Farysia* (see Vánky, 1987:40-41). Species of *Sphacelotheca* are restricted to host plants in the Polygonaceae (Vánky & Oberwinkler, 1994:7-9). A central columella could not be found in the sori of "*Sphacelotheca*" *caricis-petitianae*. The typical violet tint of the spores of *Sphacelotheca* is also lacking in this species. Instead, fascicles of sterile hyphae, typical for *Farysia*, are abundant in the sori.

EXCLUDED SPECIES

TUBURCINIA PENNISETI IS A RUST FUNGUS

Mishra (1957:256) described *Tuburcinia penniseti* J. N. Mishra, on the leaves of *Pennisetum hordeoides* (Lam.) Steud., from India, Bihar, Netarhat, alt. 3500 feet, collected by himself, and deposited in BPI (178976), HCIO, and IMI (68182!).

Tuburcinia Fries is considered (Vánky, 1987:122) a synonym of the smut fungus genus *Urocystis* Rbh. ex Fuckel (nom. cons.). However, the description of *T. penniseti* and its illustration (Mishra, 1957:258, figs. 1–4) do not fit with the characters of a *Urocystis*. The study of the type of *T. penniseti* showed that it represents a rust fungus. Dr. Reinhard Berndt kindly identified it as *Phakopsora apoda* (Pat. & Har.) Mains (Phakopsoraceae, Uredinales).

USTILAGO PARVULA AND *U. SETARIAE-AUREAE* ARE *USTILAGINOIDEA*

Ustilago parvula H. Sydow (in Sydow & Petrak, 1931:184) was described on *Ischaemum arundinaceum* F. Muell. var. *radicans* Hack. from the Philippine Islands, Prov. Benguet, Baguio, collected by M. Clemens (7231) on 16.XII.1925.

According to the original description, the sori develop in the ovaries destroying them and transforming them into 2–3.5 mm long, black, subpulverulent bodies. The spores are globose to subglobose, 4–5.5 μm in diameter, olivaceous-brown, in proportion to the small spore size coarsely, sparsely verrucose.

The holotype of this species was lost in Berlin (B) during World War II, but there is an isotype in the Kew herbarium. This represents spores of a *Ustilaginoidea* (Mitosporic fungi; Fungi Imperfecti). The sori and the spores of this isotype correspond with the description given by H. Sydow in the protologue of *Ustilago parvula.*

Ustilago setariae-aureae Hennings (1907:86) was described on *Setaria aurea* A. Br. (= *S. sphacelata* (Schum.) Moss var. *aurea* (A. Br.) W. D. Clayton) from Congo, Prov. Leopoldville, Dembo, VI. 1906, H. Vanderyst (B 28). Holotype in BR!, isotypes in BPI 166389!, 166390!, 194472!).

According to the short original description, the black, pulverulent sori are in the ovaries, destroying them. The spores are subglobose, dark olivaceous-brown or blackish-brown, 3.5–4.5 µm in diameter, verrucose.

The study of the type specimens revealed that it is also a *Ustilaginoidea* species (Mitosporic fungi), identical with the previous fungus.

ACKNOWLEDGEMENTS

I am grateful to Dr. S. Tóth (Gödöllő, Hungary) for providing the Latin descriptions, to Dr. R. G. Shivas (Brisbane, Australia), and to Dr. R. Berndt (Tübingen, Germany) for reading the manuscript and serving as pre-submission reviewers. Dr. R. Berndt also identifyed "*Tuburcinia penniseti*" as *Phakopsora apoda*. Thanks are also due to the Directors and Curators of the Herbaria BPI, BR, BRIP, HCIO, IMI and PC for loans and/or exchanges of specimens.

LITERATURE CITED

Ainsworth, G. C. 1941. Contributions towards the fungus flora of Uganda. IV. The Ustilaginales of Uganda. – Proc. Linn. Soc. London 153(1):92-97.

Clayton, W. D. & Renvoize, S. A. 1986. Genera graminum. Grasses of the world. – London, 389 pp.

Clinton, G. P. 1902. North American Ustilagineae. – J. Mycol. 8:128-156.

— 1904. North American Ustilagineae. – Proc. Boston Soc. Nat. Hist. 31:329-529.

Durán, R. & Fischer, G. W. 1961. The genus *Tilletia*. – Washington State University, 138 pp.

Ellis, J. B. & Everhart, B. M. 1891. New species of Uredineae and Ustilagineae. – J. Mycol. 6:118-121.

Farlow, W. G. & Seymour, A. B. 1888-91. A provisional host-index of the fungi of the United States. – Cambridge.

Fischer, G. W. 1952. Some new species of Ustilaginales from North America. – Res. Stud. State Coll. Wash. 20:3-10.

Fraiture, A. 1997. Champignons récoltés par J. Léonard dans le désert de Libye et au Lac Tchad (1968). – Bull. Jard. Bot. Natl. Belg. 66:163-174.

Hennings, P. 1907. Fungi. In Wildeman, E. de, Études de systematique et de géographie botaniques sur la flore du Bas- et du Moyen-Congo. – Ann. Mus. Congo, Sér. 5, Bot. 2:85-106.

— 1908. Einige neue parasitische Pilze aus Transvaal, von Herrn T. B. R. Evans gesammelt. – Bot. Jahrb. Syst. 41:270-273.

Hirschhorn, E. 1939. Las especies del genero *Ustilago*. – Darwiniana 3:347-418 + Pls. I-VI.

— 1942. Adiciones y correcciones a las especies del genero *Ustilago* en la Argentina. – Anales Soc. Ci. Argent. 133:217-218.

— 1986. Las Ustilaginales de la flora Argentina. – La Plata, 530 pp.

Holl, F. 1830. Verzeichnis der auf der Insel Madeira beobachteten Pflanzen, nebst Beschreibung einiger neuen Arten. – Flora 13:369-392.

Kühn, J. 1876. *Ustilago rabenhorstiana*. – Hedwigia 15:4-6.

Ling, L. 1945. A contribution to the knowledge of the Ustilaginales in China. – Mycol. Pap. 11:1-12.

Mishra, J. N. 1957. Ustilaginales of Bihar. III. Some new and interesting smuts. – Mycologia 49:256-261.

Patouillard, N. 1906. Champignons Algéro-Tunisiens nouveaux ou peu connus. – Bull. Soc. Mycol. France 22:195-200.

Peck, C. H. 1875. Report of the botanist. – Annual Rep. New York State Mus. 27:73-116.

Saccardo, P. A. 1876. Fungi veneti novi vel critici. Series V. – Nuovo Giorn. Bot. Ital. 8:161-211.

— 1899. Ustilaginaceae Tul. (by P. A. Saccardo & P. Sydow). In Sylloge fungorum, etc. 14:410-431.

— 1912. Sylloge fungorum, etc. 21:497-528.

Schweinitz, L. D. de 1834. Synopsis fungorum in America Borealis media degentium. – Trans. Amer. Philos. Soc., N. S., 4:141-316 + Pl.

Spegazzini, C. 1902. Mycetes argentinenses (Series II). – Anales Mus. Nac. Buenos Aires, Ser. 3, 1:47-89.

— 1909. Mycetes argentinenses. Ser. IV. – Anales Mus. Nac. Buenos Aires, Ser. 3, 12:257-458.

Sydow, H. 1926. Über einige südafrikanische Pilze – Ann. Mycol. 24:265-272.

— 1935. Beschreibungen neuer südafrikanischer Pilze – Ann. Mycol. 33:230-237.

—, Sydow, P. & Butler, E. J. 1906. Fungi Indiae orientalis. Pars. I. – Ann. Mycol. 4:424-445.

— & Petrak, F. 1931. Micromycetes philippinenses. – Ann. Mycol. 29:145-279.

Thirumalachar, M. J. & Mundkur, B. B. 1951. Revisions of and additions to Indian fungi. III. – Mycol. Pap. 40:1-15.

— & Pavgi, M. S. 1952. Notes on some Indian Ustilagineae. V. – Sydowia 6:389-395.

Vánky, K. 1987. Illustrated genera of smut fungi. – Cryptogamic Studies 1:1-159 (ed. W. Jülich). Gustav Fischer Verlag, Stuttgart / New York.

— 1990. Taxonomical studies on Ustilaginales. V. – Mycotaxon 36:473-482.

— 1991. Taxonomical studies on Ustilaginales. VII. – Mycotaxon 40:157-168.

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NEW SPECIES OR INTERESTING RECORDS OF FOLIICOLOUS LICHENS. V. TWO NEW SPECIES OF FELLHANERA (LICHENIZED ASCOMYCOTINA: PILOCARPACEAE) WITH 1-SEPTATE ASCOSPORES

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Abstract: Two new foliicolous species of *Fellhanera* with 1-septate ascospores are described: *F. misionensis* Ferraro & Lücking, known from various parts in the Neotropics, and *F. substanhopeae* Lücking, collected in northern South America. *F. misionensis* is characterized by a farinose thallus and rather large, dark brown apothecia. The characteristic traits of *F. substanhopeae* are the coarsely verrucose thallus and the dark purplish brown apothecia with flat disc and whitish margin.

Introduction

The genus *Fellhanera* (Lecanorales: Pilocarpaceae) was established by VEZDA (1986) to accomodate species formerly placed in the artificial genera *Catillaria*, *Bacidia*, and *Lopadium* (SANTESSON 1952). *Fellhanera* is characterized by biatorine apothecia with a typically paraplectenchymatous exciple, asci with a I+ tubular structure, and *Bilimbia*-type ascospores. Originally containing 19 species, the genus rapidly increased in size and is presently one of the largest regarding foliicolous lichens, with 45 species (MATZER 1996; SÉRUSIAUX 1996; LÜCKING 1997).

Important features for specific delimitation in *Fellhanera* are thallus outline, surface structure and chemistry, apothecial size and colour, excipular cell size and presence of crystals, colour of epithecium, hypothecium and apothecial base, and ascospore septation and size (SÉRUSIAUX 1996; LÜCKING 1997). The almost free variation of these characters results in a large number of possible combinations, and new species are continuously discovered. With regard to ascospore septation, the 3-septate state is clearly predominant in the genus. However, in the present paper two new taxa with 1-septate ascospores are described.

Fellhanera misionensis Ferraro & Lücking sp.n. Figs 1A-B, 2A

A *Fellhanera rhapidophylli* thallo et apotheciis similis sed ascosporis 1-septatis differt. Apothecia usque at 0.7 mm in diam. Pycnidia non visa.

Typus: ARGENTINA. Misiones: Depto. Guaraní, Predio Guaraní, picada del límite del Predio, desde ruta 15 al E, 1500 m, sobre hojas de Bignoniaceae, IX. 94, Maruñak et al. 731 (CTES, holotype; hb. Lücking, isotype).

Thallus epiphyllous, continuous, minutely farinose to almost granulose, pale greenish to brownish grey, up to 15 mm in diam. and 10-15 µm thick. Phycobiont a species of Chlorococcaceae; cells 5-9 µm in diam. Apothecia sessile, basally constricted, regularly rounded, 0.3-0.7 mm in diam. and 0.15-0.20 mm high; disc at first flat, in old apothecia slightly convex, dark brown to blackish brown; margin thin, pale, soon disappearing. Exciple paraplectenchymatous, without crystals, colourless; cells 5-10 µm in diam. Hypothecium pale yellowish, 20-30 µm high; apothecial base dark brown. Hymenium colourless, 55-70 µm high. Paraphyses 1.0-1.5 µm thick, slightly branched and anastomosing. Asci clavate, 50-65 x 12-15 µm. Ascospores 8 per ascus, ellipsoid, 1-septate, colourless, (11-) 14-18 x 4.0-5.5 µm. Pycnidia not observed.

Notes: *Fellhanera misionensis* belongs to the *F. fuscatula* aggregate in the *F. fuscatula* group, as defined by Lücking (1997). The species of this aggregate, which includes the generic type *F. fuscatula*, have a continuous, farinose thallus and brown apothecia and generally lack secondary substances (Lücking et al. 1994). The conidia, as far as they are known, are fusiform to bacillar. With its 1-septate ascospores, *F. misionensis* represents one end of a continuous transition towards the muriform type, including *F. rhapidophylli* (Rehm) Vezda (3-septate), *F. subfuscatula* Lücking (5-septate), *F. fuscatula* (Müll. Arg.) Vezda (7-septate), *F. longispora* Lücking (9-11-septate), *F. paradoxa* (Vezda) Vezda (submuriform), and *F. dictyospora* Lücking (muriform).

Two further species of this group have 1-septate ascospores. *Fellhanera encephalarti* (Vezda) Vezda, known from tropical Africa, differs by smaller apothecia (0.2-0.3 mm) and ascospores (10-12 x 3.5-4.5 µm). *F. vandenberghenii* (Sérus.) Vezda, also from tropical Africa, agrees in most aspects with *F. misionensis* but has a thicker, distinctly granulose thallus, a darker hypothecium, smaller ascospores (9-13 x 4-5 µm) and beaked pycnidia. Pycnidia are unknown in *F. misionensis*, but the other features, together with the different geographical distribution support our view that *F. misionensis* represents a separate taxon.

Additional specimens examined: COSTA RICA. San José: Braulio Carrillo National Park, 1500 m, I. 1992, R. Lücking 92-4763 (hb. Lücking). Chirripó National Park, 2550-2800 m, II. 1992, R. Lücking 92-444 (hb. Lücking). Cartago: Tapanti National Wildlife Refuge, La Pava trail, 1500-1700 m, II. 1992, R. Lücking 92-25 (LG, hb. Lücking). Birrisito, 1200 m, *Citrus* and *Mangifera* trees and coffee plantations, IX. 1991, R. Lücking 91-2793 (hb. Lücking). — ECUADOR. Napo: Jatun Satcha Biological Station, 25 km E of Tena at Río Napo, 450 m, V. 1996, R. Lücking 96-136 (QCA). Pichincha: Guajalito Biological Station, 45 km W of Quito on W slope of the Cordillera Occidental, 1800 m, V. 1996, R. Lücking 96-204 (QCNE, hb. Lücking). — BRASIL. Pernambuco: Reserva Municipal de Bonito, VIII. 1998, Cáceres 98-628 (hb. Cáceres). — PARAGUAY. Itapúa: El Tirol, parque del Hotel Tirol, sobre hojas de *Monstera*, X. 1993, C. L. Cristobal & A. Krapovickas 2309 (CTES, hb. Lücking).

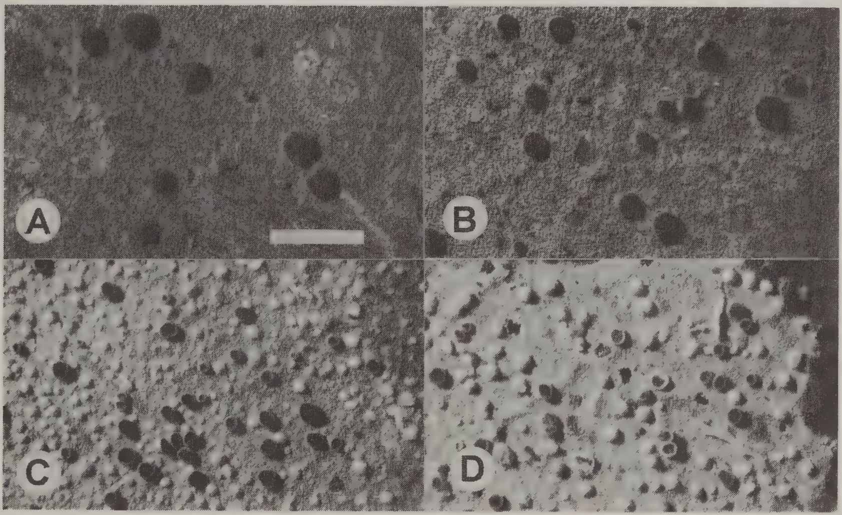

Figure 1: (A-B) *Fellhanera misionensis* sp.n., thallus with apothecia [A: Argentina, Ferraro et al. 6034 (CTES); B: Bolivia, Krapovickas 46774 (CTES)]. (C-D) *F. substanhopeae* sp.n., thallus with apothecia [A: isotype (hb. Lücking); B: Guyana, Lücking 96-3619 (hb. Lücking). — Scale = 1 mm.

Fellhanera substanhopeae Lücking sp.n. Figs 1C-D, 2B

A *Fellhanera stanhopeae* apotheciis minoribus et ascosporis 1-septatis differt.

Typus: BRAZIL. Pará: Biologische Station Caxiuanã, 300 km W von Belém, Tieflandregenwald auf terra firme, 25 m, 27.-29. V. 1995, R. Lücking 95-70 (M, holotype; isotypes to be distributed in Lücking: Lichenes Foliicoli Exsiccati).

Thallus epiphyllous, continuous, verrucose, up to 20 mm in diam., verrucae hemisperical, 0.1-0.2 mm in diam., whitish, between the verrucae smooth to very minutely farinose, greenish grey. Phycobiont a species of Chlorococcaceae; cells 4-8 µm in diam. Apothecia sessile, basally constricted, regularly rounded, 0.2-0.4 mm in diam. and 0.1-0.15 mm high; disc flat, dark brown to blackish brown; margin thin but distinct and persistent, whitish. Exciple strongly encrusted with colourless crystals which dissolve in KOH, then composed or irregular threads of inflated cells. Hypothecium dark brown, 30-60 µm high; apothecial base dark brown. Hymenium colourless, 35-45 µm high. Paraphyses 1.0-1.5 µm thick, branched and anastomosing. Asci clavate, 35-40 x 7-10 µm. Ascospores 8 per ascus, oblong, 1-septate, colourless, 8-11 x 2-3 µm. Pycnidia not observed.

Notes: This new species is externally similar to *Fellhanera stanhopeae* (Müll. Arg.) Lücking, Lumbsch & Elix, a widespread and common neotropical taxon (Santesson 1952; Lücking et al. 1994). *F. substanhopeae* deviates by the distinctly smaller and constantly 1-septate ascospores and further by the smaller apothecia and verrucae and the otherwise almost smooth thallus. At first, we considered it a locally restricted variety of *F. stanhopeae*, but the wider distribution in northern South America indicated by the locality in Guyana and the co-occurrence of both taxa within this area suggest recognition at the species level.

Additional specimen examined: GUYANA. Potaro / Siparuni: Paramakatoi, 900-1200 m, trail SW of village, II. 1996, R. Lücking 96-3619 (hb. Lücking).

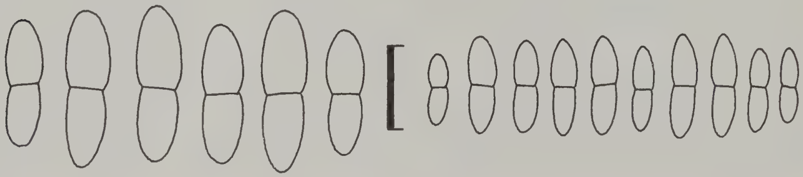

Figure 2: (A) *Fellhanera misionensis* sp.n., ascospores (holotype). (B) *F. substanhopeae* sp.n., ascospores (holotype). — Scale = 10 µm.

Discussion

Besides the couples *Fellhanera bouteillei* (Desm.) Vezda / *F. subternella* (Nyl.) Vezda and *F. semecarpi* (Vain.) Vezda / *F. pauciseptata* (R. Sant.) Lücking (Santesson 1952; Lücking 1997), the species described here and their close relatives represent further examples of taxa with identical morphology but different ascospores. This pattern confirms the assumption that adaptive radiation within the genus first took place on the level of morphology, followed by the evolution of different ascospore types in several lines (Lücking 1997). As a consequence, species with 1-septate ascospores are not closely related and morphologically rather well distinguished from each other (Table 1).

Still, it is unclear whether the 1- or the 3-septate state is more primitive. The fact that the 3-septate state is dominant in the genus while 1-septate ascospores are rare, and the occurrence of intermediates between different morphotypes in the former group, while they are absent in the latter, suggests species with 1-septate ascospores as derived from 3-septate ancestors. Distribution patterns are ambiguous: while in the couples *F. bouteillei* (1-septate) / *F. subternella* (3-septate) or *F. semecarpi* (1-septate) / *F. pauciseptata* (1-3-septate), species with 1-septate ascospores are more widely distributed and abundant, in *F. misionensis* (1-septate) / *F. rhapidophylli* (3-septate) or *F. substanhopeae* (1-septate) / *F. stanhopeae* (3-septate), the respective taxon with 1-septate ascospores has a restricted distribution.

Table 1: Comparison of morphological and anatomical features of species of *Fellhanera* with 1-septate ascospores.

Species	**Thallus outline**	**Thallus surface**	**Thallus colour**	**Apothecia size (mm)**	**Apothecia colour**	**Ascospore size (µm)**
F. encephalarti	continuous	farinose	greenish grey	0.20-0.25	blackish brown	10-12 x 3.5-4.5
F. misionensis	continuous	farinose	greenish grey	0.30-0.70	dark brown	11-18 x 4.0-5.5
F. vandenberghenii	continuous	farinose	whitish grey	0.15-0.50	dark brown	9-13 x 4.0-5.0
F. congesta	continuous	farinose	brownish grey	0.20-0.40	reddish brown	6-10 x 1.5-2.0
F. bouteillei	continuous	farinose	bluish grey	0.10-0.40	yellowish orange	10-18 x 3.0-6.0
F. parvula	continuous	farinose	greenish grey	0.10-0.20	pale yellow	6-11 x 2.0-2.5
F. substanhopeae	continuous	verrucose	green	0.20-0.40	dark brown	8-11 x 2.0-3.0
F. semecarpi	dispersed	smooth	grey	0.10-0.20	ochraceous	10-16 x 4.0-5.0

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References

LÜCKING, E. (1997): Additions and corrections to the knowledge of the foliicolous lichen flora of Costa Rica. The genus *Fellhanera*, with notes on *Bacidia pauciseptata*. — Tropical Bryology 13: 141-173.

LÜCKING, R., LUMBSCH, H. T. & ELIX, J. A. (1994): Chemistry, anatomy, and morphology of foliicolous species of *Fellhanera* and *Badimia* (Lichenized Ascomycotina: Lecanorales). — Botanica Acta 107: 393-401.

MATZER, M. (1996): Lichenicolous ascomycetes with fissitunicate asci on foliicolous lichens. — Mycological Papers 171: i-x, 1-202.

SANTESSON, R. (1952): Foliicolous lichens. A revision of the taxonomy of the obligately foliicolous, lichenized fungi. Symb. Bot. Ups. 12: 1-590.

SÉRUSIAUX, E. (1996): Foliicolous lichens from Madeira, with the description of a new genus and two new species and a world-wide key of foliicolous *Fellhanera*. — Lichenologist 28: 197-227.

VEZDA, A. (1986): Neue Gattungen der Familie Lecideaceae s. lat. (Lichenes). Folia Geobotanica et Phytotaxonomica, Praha, 21: 199-219.

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SOUTH AFRICAN FUNGI 10: NEW SPECIES, NEW RECORDS AND SOME NEW OBSERVATIONS

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Ten species belonging to the Agaricaceae, Coprinaceae and Strophariaceae are described. Accounts of two new taxa are included viz *Coprinus gelatinosus* and *Hymenagaricus pallidodiscus*, while *Copelandia cyanescens* and *Hypholoma subviride* are recorded for the first time from South Africa. *Coprinus micaceus*, previously considered a common and widespread taxon is shown to have been frequently confused with *C. truncorum*, and is now known to be rare; it is *C. truncorum* which is the common taxon. Accounts are given of *Panaeolus antillarum, Panaeolina foenisecii*, and *Coprinus atramentarius,* which are poorly known in the region, especially around Pretoria. Finally a description is given of the bright orange-red *Stropharia aurantiaca,* characteristic of mulched flower beds and a probable recent introduction to South Africa.

Key words: Agaricaceae, Coprinaceae, Strophariaceae, *Copelandia cyanescens, Coprinus atramentarius, C. gelatinosus, C. micaceus, C. truncorum, Hymenagaricus pallidodiscus, Hypholoma subviride, Panaeolina foenisecii, Panaeolus antillarum, Stropharia aurantiaca,* South Africa

Introduction

In this paper the species, which have been selected for inclusion, have been grouped according to their respective families, subfamilies and/or tribes. The collections are preserved in **PRUM**, (Mycology Section of **PRU**, the H.G.W.J. Schweickerdt Herbarium), unless otherwise indicated.

Agaricaceae Cohn
Tribe Agariceae Pat.

Hymenagaricus pallidodiscus Reid & Eicker, sp. nov.
Fig. 1 e-h.

Sporophora ab initio parabolica non nisi tarde et leviter campanulata, in pileum disco centrali pallido abrupte delimitatum, ceterum squamis minute granularibus albis vestitum. **Pileus** parabolicus, 10-11 mm altus, 8-11 mm latus, dein tarde aliquantum

campanulatus, ubi expansus usque 18 mm latus, albus disco centrali pallide griseo-bubalino abrupte delimitato, ceterum squamis minutis albis granulato-punctatis dense vestitus. **Lamellae** plus minusve liberae, albae dein roseo-bubalinae, dein brunneolae. **Stipes** 27-37 mm longus, 2.0-3.5 mm latus, cylindricus vel basin versus leviter expansus vel attenuatus, albus, ex parte basalis dense et valde gossypino- fibrillosus, velo cortinato stipiti insidentes, vel ad marginem pilei appendiculato. Pileus, stipes et contextus ubi contusus rubescens. **Discus pilei** cum strato parenchymato usque 50 μm crassus vel ultra, cellulis hyalinis, tenuiter tunicatis, globosis subglobosis ovalibus vel rectangularibus, usque 9-17 x 8-12 μm in catenis indistinctis formatus. Hoc stratum parenchymatum ad superficie in strato hymeniformi, monostrato terminans. Hoc stratum hymeniforme cellulis hyalinis, tenuiter tunicatis, subcylindricis, clavatis vel ovalibus, usque 16-27 x 7-13 μm d. metientibus. **Trama lamellarum** regularis vel subregularis, hyphis hyalinis, usque 10 μm d., tunicis tenuibus et sine fibulis instructis. **Cheilocystidia** 15-40 x 7-10 μm, tenuiter tunicata, hyalina, cylindrica, clavata vel raro ovata. **Basidia** 18.5-21.5 x 7.0 μm, tenuiter tunicata, hyalina, clavata, et quadrispora. **Sporae** 5.2-7.0 x 3.5-4.5 μm brunneae, ellipticae vel late ellipticae, et tunicis crassiusculis instructae.
On ground in plant debris under *Cupressus* sp. Botany Department Garden, University of Pretoria Campus, D.A. Reid, 13 May 1999. **PRUM** 4458 (Holotype).

Sporophores at first parabolic, only slowly expanding and becoming slightly campanulate; the pileus with central disc pale and abruptly delimited, and elsewhere covered with minute, white, granular scales on a white background. **Pileus** parabolic, 10-11 mm high, 8-11 mm wide, becoming slowly, more or less campanulate, when expanded to 18 mm wide, with a central pale grey-buff, abruptly delimited disc, for the remainder densely covered with minute, white, granular-punctate scales. **Lamellae** more or less free, white, becoming rosy buff and finally brownish. **Stipe** 26-37 mm long 2.0-3.5 mm wide, cylindrical, but toward the base slightly expanded, or attenuated downward, white, densely cottony-fibrillose on lower two-thirds from the strongly developed cortinate veil, which often leaves appendiculate remnants on the pileal margin. On handling the pileus, stipe and flesh bruise red to red brown. **Pileal disc** comprising a parenchymatous layer up to 50 μm thick or more, of hyaline, thin-walled, globose, subglobose, oval or rectangular cells, to 9-17 x 8-12 μm, in indistinct chains. At the surface of the pileal disc this parenchymatous layer terminates in a monostratous, hymeniform layer of thin-walled, hyaline elements, 16-27 x 7-13 μm, varying in shape from subcylindric to clavate or ovate. **Trama of lamellae** regular or subregular, with thin-walled, hyaline hyphae to 10 μm wide, lacking clamp-connections. **Cheilocystidia** 15-40 x 7-10 μm, thin-walled, hyaline, varying in shape from cylindric or clavate, or occasionally to ovate. **Basidia** 18.5-21.5 x 7.0 μm, thin-walled, hyaline, clavate, 4-spored. **Spores** 5.2-7.0 x 3.5-4.5 μm, brown, elliptical or broadly elliptical, with slightly thickened walls.

Habitat: On the ground in plant detritus under *Cupressus* sp., Botany Department Garden, Unversity of Pretoria Campus, D.A. Reid, 13 May 1999. **PRUM** 4458 (Holotype)

Distribution in South Africa:
Hymenagaricus pallidodiscus is known only from the type collection.

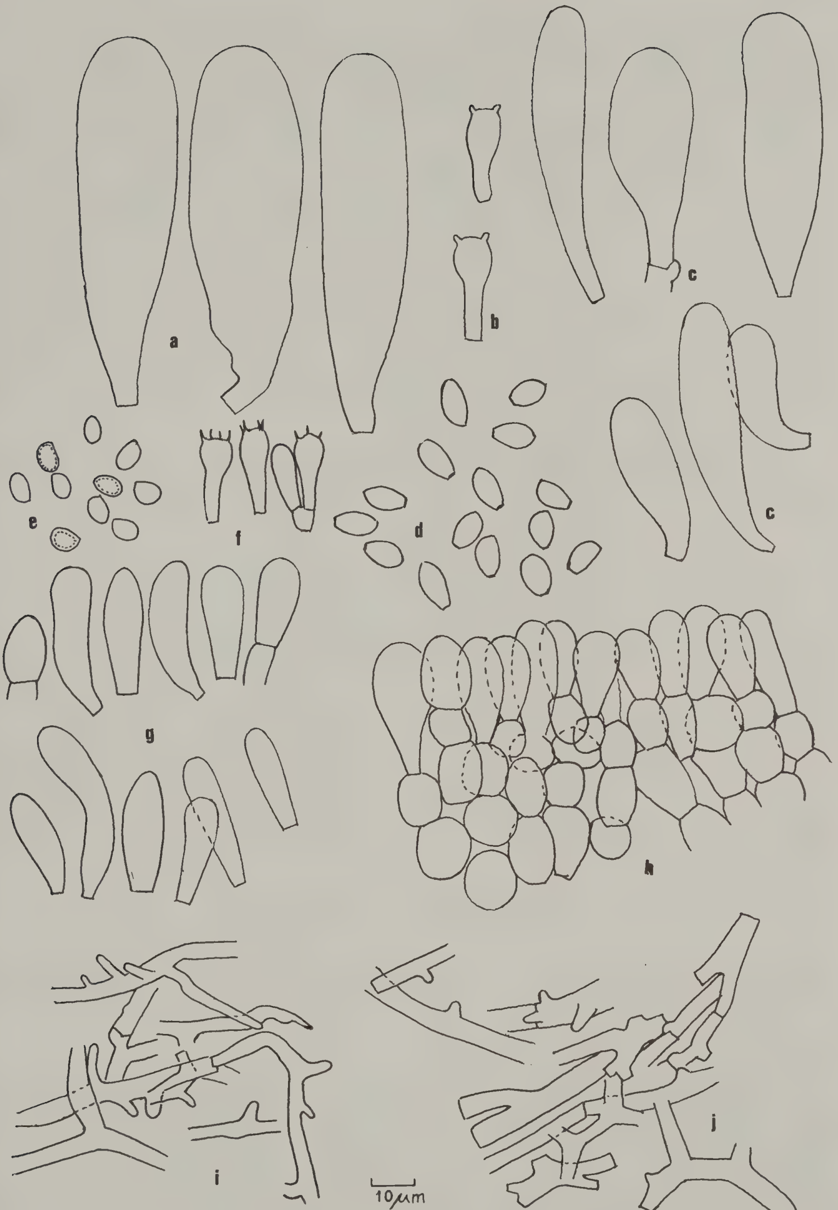

Fig. 1. a-d *Coprinus atramentarius*. a. Pleurocystidia. b. Basidia. c. Cheilocystidia. d. Spores (all from **PRUM** 4449); e-h *Hymenagaricus pallidodiscus*. e. Spores. f. Basidia. g. Cheilocystidia. h. Vertical section through pileal disc. (all from **PRUM** 4475, ie Holotype). i-j *Coprinus gelatinosus*. i. Structure of floccose scales on pileus (**PRUM** 4454). j. As previous (**PRUM** 4155 ie Holotype).

Discussion: *H. pallidodiscus* is closely related to *H. alphitochrous* (Berk. & Br.) Heinm.- a widespread species, which according to Pegler (1986) "probably has a wide palaeotropical distribution," having been recorded from Ghana, Kenya, Tanzania and Uganda, although originally described from Sri Lanka. However, *H. alphitochrous* differs from *H. pallidodiscus* in that the conico-campanulate pileus of the former expands and becomes flattened or even slightly depressed, whereas in the latter it expands only tardily to become more or less campanulate; the expanded pileus of *H. alphitochrous* has a dark vinaceous brown, abruptly defined central disc, contrasting with the pale vinaceous pink background with scattered, minute flocci, while in *H. pallidodiscus* the central disc is pale grey-buff and the background white, with a dense cover of white granular-punctate scales; in *H. alphitochrous* the pileal margin is finely striate whereas in *H. pallidodiscus* it is smooth; finally in *H. alphitochrous* the cheilocystidia are globose, pyriform or clavate, while in *H. pallidodiscus* these organs are cylindric or clavate and only occasionally ovate.

In our recently revised key to species of *Hymenagaricus* occurring in South Africa, (Reid & Eicker, 1998) *H. pallidodiscus* would key out at couplet 4, next to *H. nigrovinosus* (Pegler) Heinemann. This latter species is very similar microscopically to *H. alphitochrous,* and like that taxon it too has a greyish lilac surface with a sharply defined black-brown central disc, in contrast to *H. pallidodiscus* in which the pileus has a central pale greyish buff disc, contrasting with an otherwise white background, densely covered with uniformly distributed, white granular scales. Further, the pileal disc of *H. nigrovinosus* comprises erect columns of hyaline, glassy, thick-walled, strongly agglutinated elements, surmounted by non-gelatinized, cylindric to slightly clavate, or rarely pyriform elements. The pileal disc of *H. pallidodiscus* is quite different, since the elements comprising the parenchymatous layer are not gelatinized, neither are they so regularly arranged. However, the cheilocystidia of *H. nigrovinosus* are also quite different from those of *H. pallidodiscus* in that they are clavate, often irregularly wavy or kinked and develop finger-like protuberances toward the apex; those of *H. pallidodiscus* are cylindric or clavate and lack protuberances.

Coprinaceae Overeem
Subfamily Coprinoideae P. Henn.

Coprinus atramentarius (Bull.: Fr.)Fr. Epicrisis Systematis Mycologici, **243**, 1838.
Agaricus atramentarius Bull. : Fr. Systema Mycologicum **1**, 308, 1821
Fig. 1 a-d.

A robust deliquescent, caespitose 'Ink Cap'. **Pileus** at maturity to 60 mm high, and 60 mm wide at the base, but deliquescing and dripping away from the margin in an inky fluid; initially ovate, expanding to conical, then conico-campanulate and finally broadly campanulate, with an abruptly truncate disc; surface with irregular radial folds or puckering, pale grey or greyish buff, with a darker greyish disc, flecked toward the centre with adpressed brown scales. **Stipe** to 95 mm high, and to 7 mm wide, silky fibrillose s.l. when young, then appearing more or less glabrous, with an obvious rim-like annular zone near the base, representing the remnants of the universal veil, and below which are fine, brown fibrils arranged in zig-zag-like lines, hollow. **Lamellae** adnate, very crowded, initially white, but changing colour with maturation of the spores, from near the pileal margin to the disc, passing from black at the pileal margin, through grey-buff to yellowish buff to cream and finally white near the disc. **Pileipellis** a rather poorly defined cutis of thin-walled, hyaline, branched, prostrate hyphae, 3.5-4.5 μm d., with clamp-connections at the septa. Toward the pileal context certain hyphae become broader, and in the context the hyphal segments may become inflated to 23 μm d. **Lamellar trama** regular. **Stipitipellis** comprising a superficial cover of narrow, thin-walled, hyaline, clamp-bearing hyphae, 3.3-7.0 μm d., followed by vertically orientated, parallel hyphae, which are also thin-walled, hyaline and bear clamp-connections at the septa, but comprise short, inflated, somewhat doliiform segments to 16.5 μm d. **Cheilocystidia** 30.0-68.0 x 12.0-18.5 μm, abundant, thin-walled, hyaline, cylindric to subcylindric or clavate, with broadly rounded apex, and prolonged below into a narrow elongated base. **Pleurocystidia** 83-87 x 19-26 μm, scattered, varying from cylindric to subcylindric, with broadly rounded apex, and tapering gradually below into short, stalk-like base. **Caulocystidia** not seen. **Basidia** 21-24 x 8.0-9.0 μm, clavate, wih a distinct stalk, thin-walled, hyaline, 4-spored. **Spores** 9.0-11.0 x 5.0-6.3 μm, with a thick, complex, dark brown wall; varying in shape from elliptic in side view, to amygdaliform in surface view, with a very minute, scarcely visible apiculus, and a central, truncate germ pore. There is also a single large globule in most spores.

Habitat: growing as a caespitose cluster of fruit-bodies, amongst grass, against the exterior of a hollow stump of Weeping Willow (*Salix* sp.) near the edge of Canoe Dam, L.C. de Villiers Sportsfield, University of Pretoria campus, 18 April 1998, Albert Eicker Jnr. **PRUM** 4449; again 9 May 1999. **PRUM** 4457.

Discussion: Doidge (1950) listed six collections of *Coprinus atramentarius* from South Africa - but those we have been able to trace are all misdetermined as follows: No 21241, Damp soil at base of rock, on side of road to Union Buildings, Pretoria, 6 April 1927, K.A. Landsdell; No 23201, same collection data as previous, 15 March 1928, native boy ‘Andries’; No 27617 Town Bush Valley, Pietermaritzburg, 1934, W.G. Rump; Nos 12997, 12999, growing inside a hollow willow tree. “This is probably the same as ‘7169 (?error for 7171) in formalin’ which was collected from the same place in the same tree and which, as it appeared to be a deliquescent kind, was preserved in formalin” Bloemfontein, 12 April 1917 (ie 12997), No 7169, Prof. G. Potts; same willow tree as for No 7169, Kings Park, Bloemfontein, 13 March 1917 (ie 12999), No 7171, Prof. G. Potts.

These collections, all in a poor state of preservation, and without notes relating to fresh material, have spores measuring 8-9 x 5-6 μm, which appear elliptic in side view and ovoid to subglobose in surface view; in addition the collection from Town Bush Valley, Pietermaritzburg was shown to possess velar remnants on the pileus comprising thin-walled, hyaline, globose elements, typical of species belonging to *Coprinus* section *Micacei*. These misdetermined collections should all be referred to *Coprinus truncorum* Schaeff. : Fr. This species is very similar in appearance to *C. micaceus* (Bull. : Fr.)Fr., differing in having spores which are not mitriform; it is listed with varietal status in Doidge (l.c.) under *C. micaceus*.

Coprinus atramentarius was noted by Levin *et al.* (1985) as ‘common’ and they observed that it occurred in the South Western Cape, Orange Free State and the

Transvaal. However, if these authors utilized the data on distribution of *C. atramentarius* in South Africa as published by Doidge (l.c.), then in view of the above discussion, their distribution data would be flawed. Van der Westhuizen & Eicker (1994) do not include *C. atramentarius* in their "Field Guide to Mushrooms of Southern Africa" and the general impression is that this species is regarded as a rarity at least in the environs of Pretoria. It is not listed by Pegler (1977) from East Africa.

C. atramentarius is widely distributed in the Northern Hemisphere.

C. atramentarius is an edible species, but if eaten, care should be taken to avoid drinking alcohol before, during, or after the meal, and one should also, as a safety precaution, abstain from taking alcohol for 1-2 days after eating it.

About 30 minutes after drinking alcohol the onset of symptoms begins as reddening of the face and neck, a tingling of fingers and toes, headaches and sickness. Recovery usually takes about 2 hours. The dramatic effect which this fungus produces when taken with alcohol has led to its popular name of 'Antabuse Fungus'. It has been given to alcoholics to cause these symptoms and hopefully eventually cure them of the habit (Phillips, 1981).

Illustrations: Illustrations of *C. atramentarius* can be found in almost any field guide to mushrooms of the Northern Hemisphere, and elsewhere, including the following: Grünert *et al.* (1991); Levin *et al.* (1985); Pacioni (1985) and Phillips (1981).

Coprinus gelatinosus Reid & Eicker, sp. nov.

Fig. 1i-j Fig. 2 a-h.

Sporophorum ovum in mentienti revocans, ab initio globosum vel pulvinatum velut sessile 4-6 mm d., sordido-album, squamis pallide griseis vel fusco-brunneis dispersis, stipite omnino invisibili et velo universale incluso. **Pileus** ab initio hemisphericus, albus, squamis ad pressis brunneus vel griseis sed ubi maturus glandiformis, campanulatus vel applanatus et margine saepe revolutescenti, ubi omnino expansus 10-22 mm d., et sulcatus, luteolo-cremeus vel diaphano-griseus, fragmentis tenuibus, albis vel luteolis velorum ornatus; hi fragmenta nonnunquam fibrilis brunneo-nigris. **Lamellae** in juventis adnexus, stipitem versus perangustae et, hac loco in rudimentis decurrentibus prolongatae, ab initio roseo-luteae, luteo-bubalinae, dein nigrae et in aetate aliquantum deliquescentes. **Stipes** usque 22 x1.5-2.0 mm, albus vel luteolus sine annulo, sed disco patelliformi, radialiter fibrilloso usque 4 mm d. instructus. **Squamae super pileum** segmentis hypharum 3-5 μm d., irregularibus 'jig-saw-like', tenuiter vel distincte tunicatis, et hyalinis formatae; Haec segmenta hypharum, projecturis brevibus obtusis, usque 10 μm longis instructa. **Hyphae** omnino septatae et fibulatae. **Hyphae stipitis** verticales parallelae, tenuiter tunicatae, hyalinae, 3.0- 6.0 μm sed nonnullae usque 13-21 μm inflatae. **Trama lamellarum** regularis, hyphis fibulatis, tenuiter hyphis tunicatis, hyalinis, 2.5 -16.5 μm d. formata. **Contextus pilei** omnino gelatinosus, sed fibulatis, 2.2-3.3 μm d., distincte sed tenuibus tunicatis, et raro ramosis; hae hyphae in matrice gelatinosa immersa. **Cheilocystidia** et **Pleurocystidia** similia, 38-58 x 13-20 μm, hyalina e cylindrico vel clavato et ad apicem late obtuso, vel lanceato vel fusiformibus et ad apicem mucronato, tunicis crassescentibus. **Basidia** magna 25-30 x

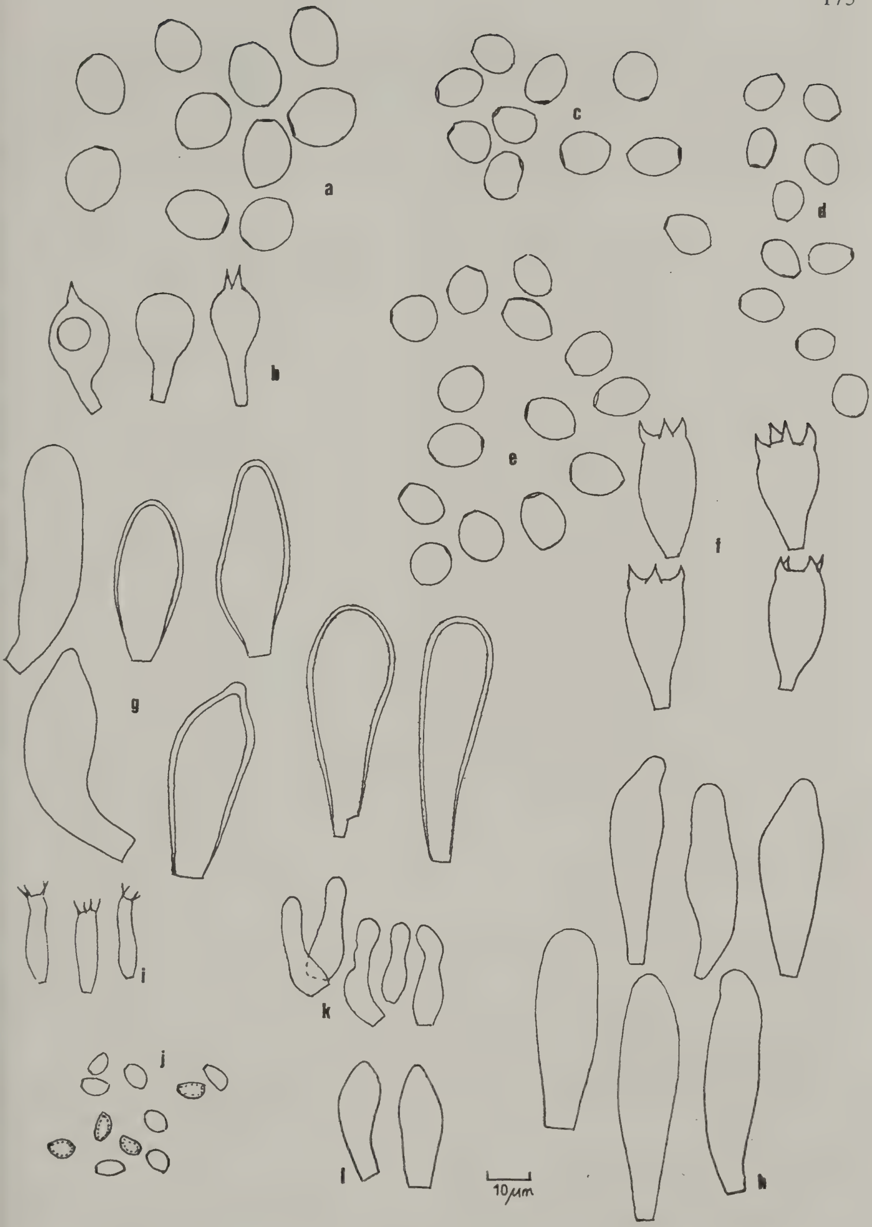

Fig. 2. a-h. *Coprinus gelatinosus* a.c.d. Spores from different fruit-bodies of **PRUM** 4155 ie Holotype. b. Basidia (**PRUM** 4155 ie Holotype). e. Spores. f. Basidia (both from **PRUM** 4454). g. Cystidia (from 4455). h. Cystidia (from 4454). *Hypholoma subviride* i-l (**PRUM** 4311) i. Basidia. j. Spores. k. Cheilocystidia. l. Chrysocystidia.

10-14 μm, tenuiter tunicata, hyalina, clavata bispora vel quadrispora. **Sporae** 9.0-12.0 (16.0) x 7.5-9.25 (10.5) x 8.5-10.0(10.5) μm, lentiformes, e insuper visa subglobosae vel ovoideae, sed e latere visa ellipsoidea, late ellipsoideae vel leviter amygdaliformes, tunica distincta vel leviter crassa, laevi, medio-brunnea instructae, et poro germinativo centrico vel excentrico, truncato munitae, et apiculo maxime inconspicuo. Sporae interdum deformes. Sporae in cumulo purpureo-atrae.

On recently fallen, small branches of *Acacia galpinii*, lying on the ground after a storm, in courtyard garden of Mathematics Department, University of Pretoria Campus, 15 March 1996, D.A. Reid and Magda Nel, **PRUM** 4155 [Holotype].

Sporophores initially egg-shaped, globose or pulvinate, appearing sessile, 4-6mm d., dirty white with scattered, pale greyish or dark brown scales; the stipe is completely invisible as it is enveloped by the universal veil. **Pileus** hemispherical and white, with black-brown or greyish, adpressed scales. At maturity the pileus expands to acorn-shaped or campanulate and finally becomes flattened, often with a revolute, sulcate margin, which curls up over the cap surface; at this stage 10-22 mm d., appearing yellowish cream, then pale diaphanous grey with white or yellowish patches of the universal veil. Some of these velar patches may show black-brown fibrils. **Lamellae** adnexed when young, but at maturity narrowing toward the stipe and continuing down the stipe apex as decurrent striae, at first pinkish yellow or yellowish buff, becoming black, and somewhat deliquescent with age. **Stipe** 22 x 1.5-2.0 mm, white to yellowish, lacking an annulus, but with a saucer-shaped, radially fibrillose disc to 4mm d., which is a rudimentary volva. **Surface scales of pileus** formed of irregular, jig-saw-like hyphal segments, 3-5μm d., with distinct walls, and occasional short, blunt projections, to about 10μm long; some of these showing faint, banded encrustation. [Hyphae of the brown pileal scales have brownish walls.] The hyphae are all septate with clamp-connections. **Hyphae of stipe** vertical, parallel, thin-walled, hyaline, 3.0-6.6 μm d., with some up to 13-21 μm d., and except for the broader hyphae, not constricted at the clamped septa; a few narrow vascular hyphae present. **Lamellar trama** regular, of thin-walled, hyaline hyphae, 2.5-16.5 μm d, with clamp-connections at the septa. **Context of pileus** entirely gelatinous, consisting of clamped, rarely branched hyphae, 2.2-3.3 μm d., with distinct, but thin walls; these hyphae immersed in a gelatinous matrix. **Cheilocystidia** and **Pleurocystidia** similar, 38-58 x 13-20 μm, hyaline., from cylindric to clavate with a broad, obtuse apex, to lanceolate or fusiform with a mucronate apex, and with walls becoming thickened. **Basidia** large, 25-30 x 10-14μm, thin-walled, hyaline, clavate, 2-4 spored. **Spores** 9.0-12.0 (16.0) x 7.5-9.25(10.5) x 8.5-10.0 (10.5) μm, lentiform, subglobose or ovoid in surface view, but ellipsoid to broadly ellipsoid to slightly amygdaliform in side view, with a distinct, slightly thickened, smooth, mid-brown wall, a small central or excentric germ pore, and a very inconspicuous apiculus. Some fruit-bodies show a variable percentage of irregularly shaped spores. Spore print purple black.

Habitat: Growing on recently fallen, small branches of *Acacia galpinii* lying on the ground after a storm, in courtyard garden of Mathematics Department, University of Pretoria Campus, 15 March 1996 D.A. Reid & M. Nel **PRUM** 4155. [Holotype]

Additional collections were made on fallen branches of *Acacia galpinii* lying on the ground, outside the main entrance to the Botany Department, University of Pretoria

Campus. D.A. Reid, 27 April 1999 [**PRUM** 4454]; on fallen branches of *Acacia galpinii* in courtyard garden of Mathematics Department, University of Pretoria, M Nel, 10 May 1999 [**PRUM** 4455]. [Same locality as the type collection].

Distribution: Known only from the three collections from the Campus of the University of Pretoria as cited above.

Discussion: *Coprinus gelatinosus* holds a rather isolated position within the genus *Coprinus* on account of its gelatinous flesh - at least while the sporophore is developing within the egg, large spores which vary considerably in size and shape, distinctive thick- walled cystidia, ranging in shape from cylindric to clavate with a broadly rounded, obtuse apex, to lanceolate or fusoid with a rostrate apex.

However, *C. gelatinosus* shares some features with *C. paleotropicus* Pegler & Redhead, such as the lignicolous habit, small size, white pileus developing brownish tints, and ornamented with white, floccose, velar fragments prosessing a similar microstructure to those of *C paleotropicus*. Nevertheless, the authors of *C. paleotropicus* make no mention of their species developing within an 'egg', and no mention of a gelatinous flesh in the developing pileus while still within the egg (not visible on hatching!), and no mention of thick-walled, lanceolate or fusiform cystidia with a rostrate apex. Further, *C. paleotropicus,* unlike *C. gelatinosus,* is a species devoid of clamp connections and its spores are decidedly smaller than those of *C. gelatinosus*. Another point for consideration is that whereas *C. paleotropicus* is shown by Pegler (1986) as arising from a small strigose disk (Pl 88, 3c), this appears to have a quite different origin from the rudimentary volva at the base of the stipe of *C. gelatinosus*. Pegler shows young, developing fruit-bodies seated in the centre of a radiating mycelial disk, which seems to be unrelated to the universal veil. It should be noted that Pegler (1977) first reported *C. paleotropicus* from East Africa under the name *C. urticicola* (Berk. & Br.) Buller, but when he subsequently discussed the species, and noted its occurrence in Sri Lanka he had a lapsus calamitosus and referred to the species in error as *C. paleocephalus* Redhead & Pegler.

Coprinus truncorum [Schaeff.]: Fr., Epicrisis Systematis Mycologici 248, 1838.
Fig. 3 a-c. Fig. 4 a-b. Fig. 5 a-b.

A caespitose fungus growing from the base of trunks, from roots or buried wood, with an ochraceous brown, parabolic cap, sprinkled toward the centre with tiny glistening, micaceous, particles derived from the veil. **Pileus** 10-25(35) mm d., 10-25 mm high, parabolic, expanding to campanulate and then up to 40 mm d., grading from yellow-brown or cinnamon at the centre, through pale ochraceous or buff, to ivory at the margin, and sprinkled toward the centre with mealy, pale buff coloured, glistening, micaceous particles, which are easily washed off by rain; toward the margin the pileus is densely striate to about halfway, and as expansion occurs, concurrently with maturation of the spores, the outer striate portion of the cap becomes greyish, and the striae pull apart, with the result that the pileus appears sulcate almost to the centre. **Stipe** 50-100 mm high, 3-6 mm wide, cylindrical, white, longitudinally silky fibrillose, becoming glabrous, except at the base, which is white tomentose. **Lamellae** adnexed, often appearing almost free, white at first, becoming cream, grey-buff, or grey, and finally black. With age there is some deliquescence of the lamellae, especially in wet conditions, but the fungus is often found in dried up clusters. **Pileipellis** an epithelium of more or less globose or subglobose, thin-walled, hyaline elements, with a short, tapered base (not always easy to see); these elements of very variable size, from 14-50 μm d. **Velar particles** on pileus comprising aggregations of thin-walled, smooth, hyaline, globose or ovate elements, 9-30 μm d., or 18-23 x 14-20 μm, initially in chains, but soon dissociating. **Lamellar trama** regular, of more or less parallel chains of short, hyaline, inflated elements, 30-40 x 13-30μm, with hyaline, rather distinct walls. **Hyphae of stipe** vertical, parallel, thin-walled, hyaline, 6-23 μm d. **Caulocystidia** not seen. **Cheilocystidia** forming a sterile gill-edge; thin-walled, hyaline, globose, 23-40 μm, or subglobose to 36 x 27 μm. **Pleurocystidia** similar to the cheilocystidia but larger, varying from globose, 26-50 μm d., to ovate, up to 60 x 40 μm, or subcylindric, to 115 x 44 μm. **Basidia** 21-27 μm long, suburniform, compring a neck 5.5-6.6 μm wide, and a swollen base 7.5-8.0 μm wide, tapering below to a prominent stalk; thin-walled, hyaline, 4-spored. The basidia are each surrounded by 4-6 thin-walled, hyaline, subglobose to ovate pseudoparaphyses, 14-19 x 12-15 μm, which due to mutual pressure can sometimes appear rectangular. **Spores** (6.0) 6.5-8.5 x 4.5-5.5 x 4.75-6.5 μm, red-brown, lentiform, ellipsoid in side view, ovoid or amygdaliform in surface view, with central, truncate germ pore, and very inconspicuous apiculus. Clamp connections lacking.

Habitat: Gauteng. On roots of dying white stinkwood (*Celtis africana),* Murray Street, Brooklyn, Pretoria, 22 October 1993, A. Eicker, **PRUM** 4002.

In addition to the above collection which has formed the basis of the foregoing account the following gatherings have been examined:

Gauteng: On damp soil at base of rock, on side of road to Union Buildings, Pretoria, 6 April 1927, K.A. Lansdell, **PREM** 21241 [Determined as *Coprinus atramentarius*]. Kwa-Zulu, Natal. Town Bush Valley, Pietermaritzburg, 1934, W.G. Rump **PREM** 27617 [Determined as *Coprinus atramentarius*]. Side of rockery on road to Union Buildings, Pretoria, 15 March 1928, Native Boy 'Andries', **PREM**, 23201. [Determined as *Coprinus atramentarius*]. Base of old *Acacia* stump, 22 March 1992, A. Eicker. **PRUM** 3340; On side of a stump, 22 April 1992, A. Eicker, **PRUM** 3256. On lawn in front of the Prof Van der Schijff Memorial Stone, 3 April 1994, **PRUM** 3884. At base of a weeping willow (*Salix* sp). L.C. de Villiers Sportsfield, University of Pretoria Campus, 1 February 1993, **PRUM** 3579. Lynnwood Glen, Pretoria, A. Eicker, 25 March 1987, **PRUM** 2333. North-West Province: In grass, presumably from buried wood, Christiana, Aventura Spa, 2 May 1999. A. Eicker and D.A. Reid, **PRUM** 4453. Eastern Cape: On dead *Eucalyptus* sp. Hogsback, 23 January 1989, A. Eicker. **PRUM** 2639. Western Cape: On pine roots, Houtkappersnek, Constantia, Cape Town, 10 April 1990, **PRUM** 3046.

Discussion: It is impossible to ascertain the precise distribution of *Coprinus truncorum* in South Africa as it has been very considerably under-recorded, owing to confusion with *C. micaceus* (Bull.: Fr.) Fr., from which it can only be distinguished after microscopic examination. However, judged from the collections which we have

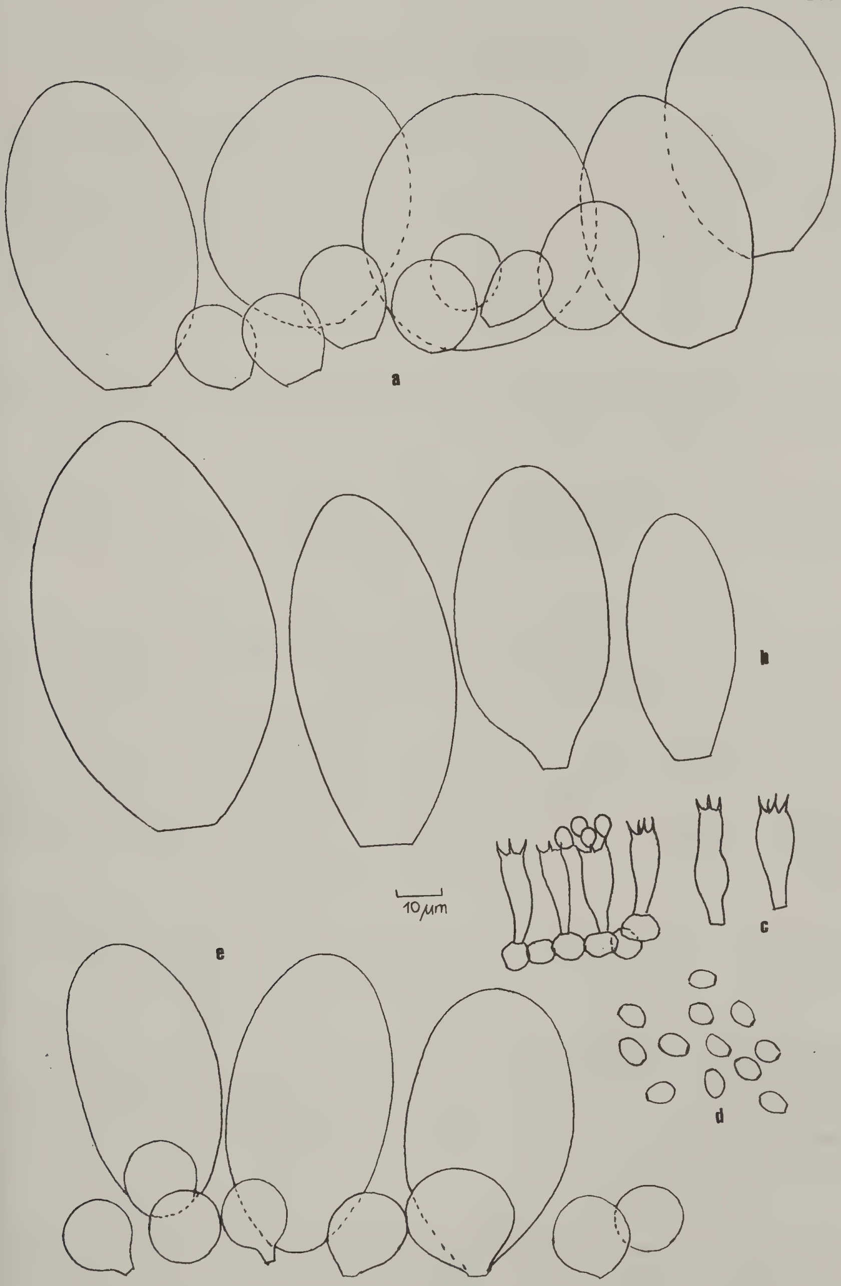

Fig. 3. a-e. *Coprinus truncorum*. a. Lamellar edge, showing cheilocystidia and pseudoparaphysoid elements. b. Pleurocystidia. c. Basidia. d. Spores (all from **PRUM** 3854). e. Lamella edge, showing cheilocystidia and pseudoparaphysoid elements (**PRUM** 3046).

studied (see above), it is clear that *C. truncorum* is both common and widespread in South Africa, and is far more frequent than *C. micaceus.*

C. truncorum is listed by Doidge (1950) but as "*Coprinus micaceus* var. *truncorum* (Schaeff. ex Fr.) Quél." Under this entry there are the following two citations: On dead trunks of trees, Natal, Medley Wood, 333, 10461; near river bank, Klein Vis Rivier, near Somerset East, MacOwan, 1214. It is also probable that several of the records listed by Doidge (l.c.) under *C. micaceus* will prove to be referable to *C. truncorum*, especially those from the vicinity of Pretoria. *C. truncorum* is not mentioned in either of the two recent Field Guides to mushrooms of South Africa by Levin *et al* (1985) and Van der Westhuizen and Eicker (1994).

C. truncorum has been reported from East Africa by Pegler (1977),, who lists a single gathering from Tanzania: Southern Highlands Province, on the ground in *Acacia* plantation, 1920 m alt., 1968.

Elsewhere there are scattered records from Europe, but it is nowhere common on that continent, although once again it is probably often confused with *C. micaceus.* In Britain Orton & Watling (1979) report that it is definitely known from Central and Southern England, but may well be more widespread.

Due to deliquescence, or partial deliquescence of the pileus, it is often difficult to observe satisfactorily, microscopic characters such as cystidia and veil structure. The cystidia, and especially the pleurocystidia, being large and thin-walled, collapse readily, and do not always revive in swelling agents such as ammonia or KOH. Those which are observed, tend to be small and can give a misleadingly low range of size for these organs. Cheilocystidia are also adversely affected during deliquescence of the lamellae and can be difficult or impossible to recover. Furthermore, it is seldom that one can recover, or adequately describe the full range of microscopic characters from study of a single gathering; for this reason the microscopic data described above has been supplemented by a study of the additional cited gatherings.

(a) Pileal Epithelium: the cap cuticle is described by Orton & Watling as 'cellular', while Pegler (1977) noted that the pileal surface is a well developed epithelium of globose to pyriform elements, 30-40 x 15-30 μm, hyaline and thin-walled.

In the collection from Botany Department Garden, University of Pretoria, **PRUM** 3884, a section of the cap cuticle showed it to consist of a multistratose epithelium, well in excess of 200 μm in thickness, comprising thin-walled, hyaline elements, which in the lower regions tend to be somewhat irregular in shape, from ovoid to subglobose, becoming more globular at the surface, but of very variable size, ranging from 17-42 μm d.

(b) Glistening velar particles on pileal surface are usually seen as small whitish or buff coloured granules, but are sometimes observed with brown tips. In such instances the terminal, thin-walled, smooth, globose elements are seen to have brown walls. When examined in microscopic squash preparations, these micaceous particles are usually seen to consist of disarticulated and disorganised thin-walled, hyaline, globose to subglobose elements, 9-30(50) μm d., or when subglobose, 15-40 x 8-30 μm.

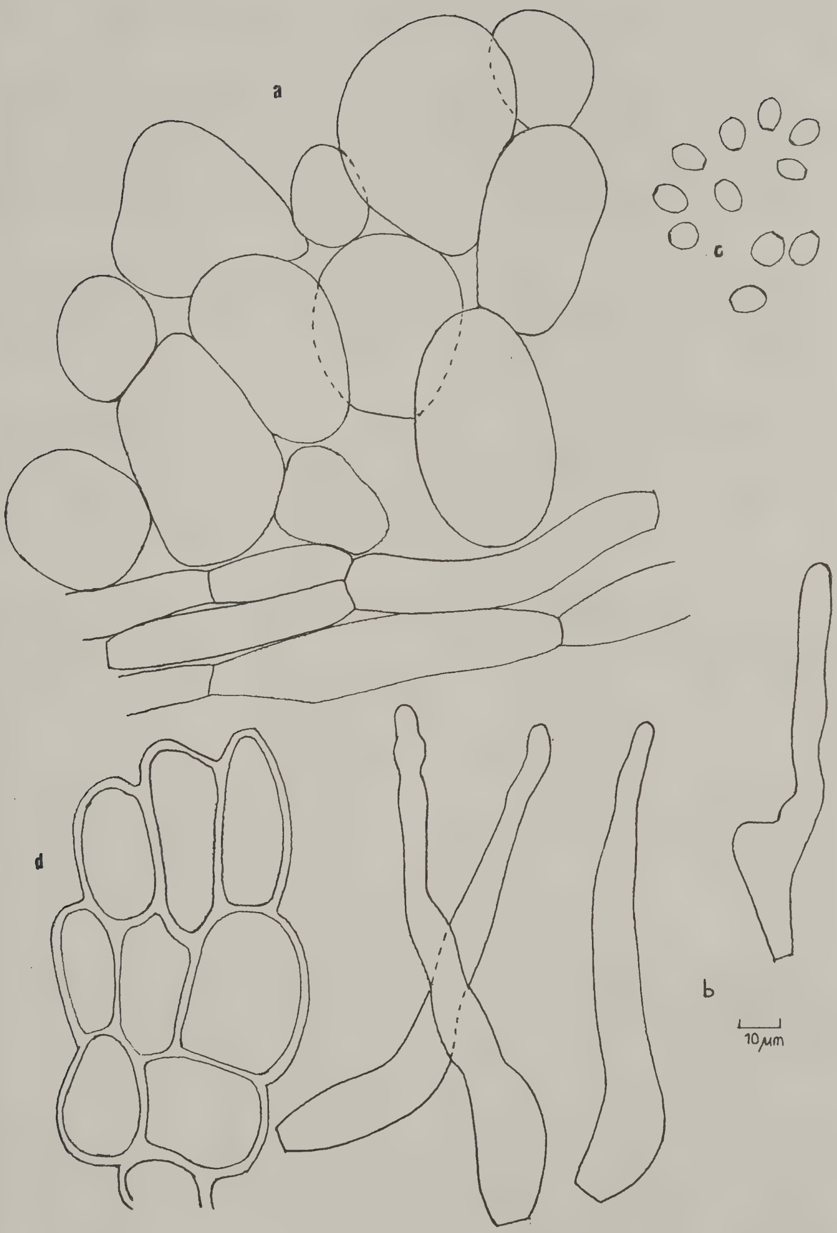

Fig. 4. a-b. *Coprinus truncorum.* a. Section of pileal surface. b. Caulocystidia (Both from **PRUM** 3884). c. Spores. d. Hyphae of lamella trama (Both from **PRUM** 4002).

However, these elements can sometimes be observed to originate in short chains, before they ultimately disarticulate.

In a collection from Botany Department Garden, University of Pretoria, **PRUM** 3340, a careful study of the velar particles has shown that they consist of chains of somewhat diverging, thin-walled hyaline elements, which in the lower regions are more or less rectangular or ovoid, 15-20 x 10-12 μm, but become progressively inflated and appear ovoid to subglobose and finally globose, whereupon they ultimately disarticulate.

(c) Cystidia. Because of the difficulty in obtaining an accurate size range for both cheilocystidia and pleurocystidia - for the reasons outlined above, the size range obtained for these organs, from the various collections is presented in tabular form to facilitate comparison. However, it is clear that these organs show considerable variation in both shape and size.

Collection Data	Cheilocystidia	Pleurocystidia
Brooklyn, Pretoria, **PRUM** 4002	Gill edge sterile, of globose to subglobose elements; when globose 23-30(40) μm, when subglobose to 36 x 27 μm. No large cheilocystidia seen.	Varying from globose, 26-50 μm d., to ovoid or obpyriform to 60 x 40 μm or subcylindric to 115 x 44 μm.
Botany Department Garden University of Pretoria **PRUM** 3256	Gill edge sterile of globose to subglobose pseudoparaphysoid elements 10-17 μm d. Cheilocystidia scattered from cylindric to slightly utriform or ovoid. 44-82 x 17.5-22.0 μm.	As cheilocystidia but larger 55-100 x 25-50 μm, or ovoid up to 100 x 63 μm.
Botany Department Garden University of Pretoria **PRUM** 3340	Gill edge sterile with globose or subglobose pseudoparaphysoid elements 20-24 μm d., grading into clavate cheilocystidia ranging from 44-50 x 21-31 μm.	Cylindric, subcylindric or ovoid to subglobose, 112-163 x 40-58 μm, when ovoid 67-100 x 45-63 μm.
Botany Department Garden University of Pretoria **PRUM** 3884	Gill edge sterile with globose or ovoid pseudoparaphysoid elements; when globose 15-18 μm d; when ovoid to 30x23 μm. Cheilocystidia globose to 53 μm d., when ovoid to 56-70 x 36-43 μm.	Ellipsoid to ovoid 35-90x20-55 μm.
Houtkapperspoort, Cape Town **PRUM** 3046	Ovoid to subpyriform to 70x40 μm	

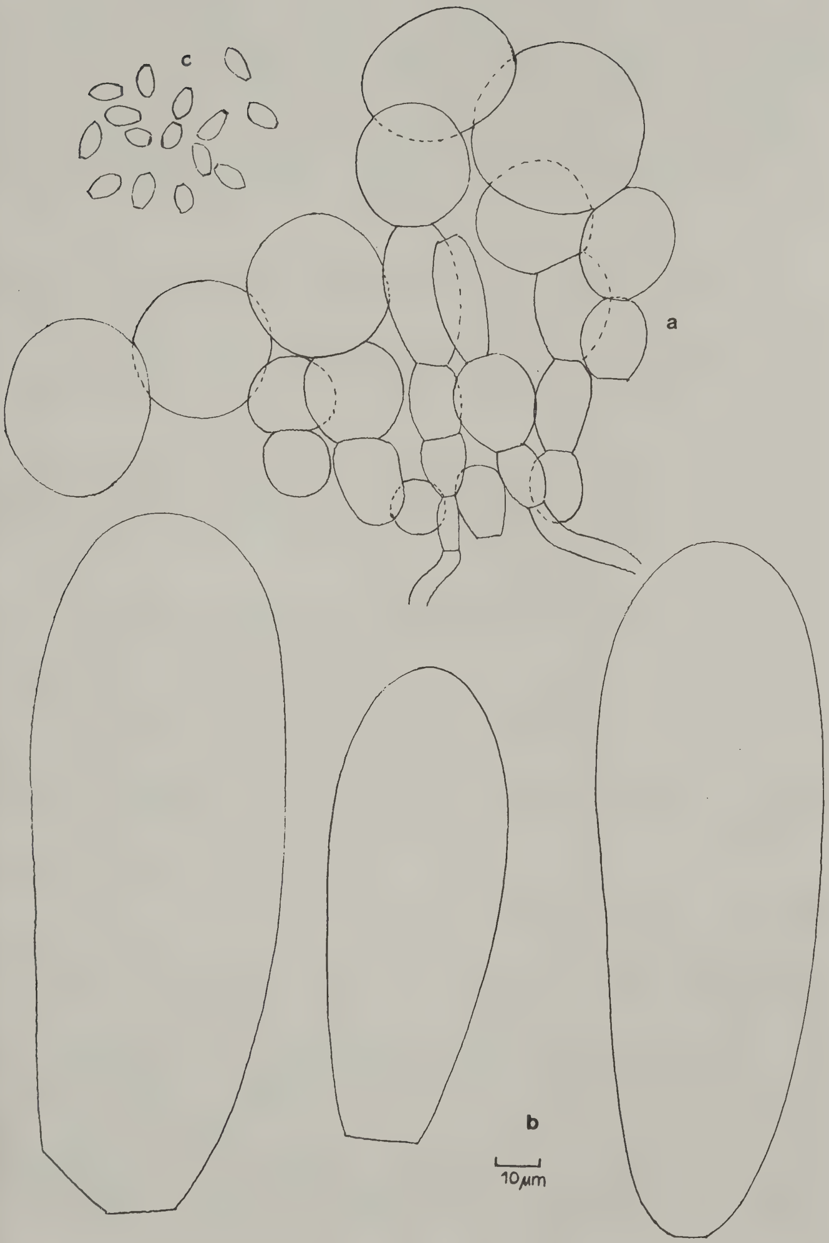

Fig. 5. a-b. *Coprinus truncorum*. a. Structure of velar granule on pileal disc. b. Pleurocystidia (Both form **PRUM** 3340). c. *Coprinus micaceus*. c. Spores (**PRUM** 3563).

(d) Caulocystidia: usually the stipe of *C. truncorum* is described as glabrous and the presence of caulocystidia is not mentioned. However, Pegler (1977) writing of *C. micaceus* does describe the stipe as “subpruinose, glabrescent”, although for *C. truncorum* he notes that the stipe is “glabrous, except for a subtomentose base”. However, in the collection from the Botany Department garden, University of Pretoria, **PRUM** 3884, hyaline caulocystidia were observed on the upper portion of the stipe as thin-walled, elongated hair-like organs to 130 μm in length. These organs comprise a swollen base 12-17 μm d., from which they taper gradually to an obtuse apex, 4-6 μm d., sometimes showing a slight constriction just above the base.

Illustrations: There are no coloured illustrations of South African material of *Coprinus truncorum*. However, since this species is macroscopically indistinguishable from *C. micaceus* (Bull.: Fr.) Fr. The following coloured plates of the latter can serve as a good likeness for *C. truncorum* viz: p. 180 in Phillips (1981), Levin *et al.* (1985) p. 73 [as *C. micaceus*] and Van der Westhuizen & Eicker (1994) p. 111 [as *C. micaceus*].

Text-figures of the microcharacters of *C. truncorum*, based on the Tanzanian gathering are provided by Pegler (1977) Fig. 91/2 a-e; and spores of British material of *C. truncorum* are illustrated by Orton & Watling (1979) Fig. 101, and can be compared with those of *C. micaceus* Fig. 100.

Taxonomy: *C. truncorum* is extremely closely related to *C. micaceus* and the two taxa are indistinguishable macroscopically. According to Orton & Watling (1979) *C. truncorum* is said to have a smooth stem and paler cap, but as these authors correctly observe, these features are also enountered in specimens of *C. micaceus*. However, under the microscope *C. truncorum* is easily distinguished by the shape of its spores, which in surface view are broadly ovoid or even subglobose, and in side view are ellipsoid. In contrast the spores of *C. micaceus* in surface view range from narrowly ellipsoid to narrowly subfusiform, and in side view from ellipsoid to narrowly amygdaliform.

Systematic Position: *Coprinus truncorum* belongs in family Coprinaceae, subfamily, Coprinoideae, genus *Coprinus,* Section Micacei.

Coprinus micaceus (Bull.: Fr.) Fr. Epicrisis Systematis Mycologici **247**, 1838
Fig. 5 c.

Macroscopically this species is indistinguishable from *C. truncorum* [Schaeff.] Fr. in having the same tufted habit, and fruit-bodies of approximately the same size and colour. However *C. micaceus* can be recognized by its spores which are red-brown under the microscope and measure (5.5)6.5-9.0 x 4.0-4.5 x 4.5-5.0 μm. They range from narrowly ellipsoid to narrowly subfusiform in surface view and from ellipsoid to narrowly amygdaliform in side view. In contrast the spores of *C. truncorum* appear broadly ovoid or even sugblobose in surface view and ellipsoid in side view.

Habitat: KwaZulu-Natal: Devilshoek, Tendele, 22 February 1993, D.A. Reid & Eicker **PRUM** 3563.

Distribution: Hitherto, *Coprinus micaceus* has been considered a common and widespread species in South Africa. For example Levin *et al* (1985) state that it is "Common after good rains in South western Cape and the Transvaal", while Van der Westhuizen and Eicker (1994) refer to it as "Common throughout Southern Africa". However, our current investigation of both fresh and herbarium material suggests that this view is erroneous. In fact we have only one firm record of *C. micaceus* from South Africa, and that is from KwaZulu-Natal, at Devilshoek, Tendele, where the climate is more temperature and comparable to that pertaining to various parts of Europe.

C. micaceus is a cosmopolitan species, which has been recorded from East Africa by Pegler (1977) who lists collections from Kenya and Tanzania.

Illustrations: Coloured illustrations based on South African material: Levin *et al.* (1985) p.73; Van der Westhuizen & Eicker (1994) p. 111, but as previously indicated these plates could equally refer to *C. truncorum.*

Illustration of *C. micaceus* can be found in virtually any field guide to mushrooms published in the Northern Hemisphere, amongst which can be cited Phillips (1981) p 180; Grunert & Grunert (1991) p 133; Pacioni (1985) p 226; Lincoff (1981) No 42 all of which are excellent.

Taxonomy: For a discussion of the taxonomy of *C. micaceus* and its separation from *C. truncorum* see under the latter species

Coprinaceae Overeen
Subfamily Panaeoloideae Singer

Copelandia cyanescens (Berk.& Br.) Singer, Lilloa **22**, 473, 1951.
Agaricus cyanescens Berk. & Br., Journ. Linn. Soc., Bot. **11**, 557, 1881.
Panaeolus cyanescens (Berk. & Br.) Sacc., Syll. Fung. **5**, 1123, 1887.
Fig. 6 a-f.

Sporophores greyish buff, campanulate, panaeoloid in appearance, blueing when bruised especially toward the stem base; distinguished by large, limoniform spores with prominent snout-like germ pore, and by the conspicuous lanceolate pleurocystidia with thick, brown walls. **Pileus** 10-20 mm d., campanulate, greyish buff with a shiny surface, more greyish toward the margin. **Lamellae** adnexed, rather crowded, dark grey, mottled, with fringed, white margin. **Stipe** to 60 mm long, 1-2 mm wide, cylindric, varying from creamy white at the apex to greyish buff below, darker at the base, with black-brown tints showing through the silvery covering, hairy pruinose above, blueing where bruised. **Pileal surface** an hymeniderm, of subglobose to ovate, thin-walled, hyaline, sphaeropedunculate elements 28-38 x 17-27 μm. **Stipe context** of parallel, thin- walled, hyaline, vertical hyphae to 19.8 μm wide, with clamps at the septa - at least on the narrower hyphae, but these clamps are difficult to demonstrate.

Cheilocystidia forming a dense sterile edge to the lamellae; lageniform, thin-walled, hyaline, 17-23 μm long, comprising a slightly inflated base, 6-8 μm wide, narrowed above to a short neck, terminating in an obtuse apex, 4-5 μm d.

Pleurocystidia metuloidal, up to 52 x 15 μm, lanceolate, prolonged above into an acute, rostrate apex, which may occasionally bear a few crystals. These pleurocystidia have thick yellow-brown walls, especially in the apical region, but thin out toward the base; they are abundant and conspicuous. **Caulocystidia** 18-60 μm long, with a swollen base 5-12 μm wide, prolonged above into a long neck, terminating in an obtuse apex, 3-8 μm wide; these organs are thin-walled and hyaline. **Basidia** 13-19 x 6-8 μm, thin-walled, hyaline, 2-spored. **Spores** (8.0) 10.0-13.0 (-16.0) x (4.5-) 7.5 x 9.0-11.5 μm, dark black-brown, thick-walled, limoniform, with an exceptionally prominent snout-like germ pore.

Habitat: Mkuzi Game Reserve, KwaZulu-Natal, 30 January 1991 (91/84), **PRUM** 3239

Distribution. In South Africa this species is known only from the above collection.

Pegler (1977) recorded *C. cyanescens* from East Africa and cited gatherings from Kenya, Tanzania and Uganda. He added that "The species is known from several tropical Asiatic countries and also tropical and South America". It was originally described from material collected in Sri Lanka. Later Pegler (1983) listed it from Trinidad, and later still he (1986) noted it as having a pantropical distribution. Stamets (1996) stated that in the United States *P. cyanescens* can be found in Hawaii, Louisiana and Florida. He further observed that it is widespread in most semitropical zones, and has been reported from Mexico, Brazil, Bolivia, the Philippines, Eastern Australia, and occasionally in the Mediterranean region (near Menton, France).

Discussion: For a more complete synonymy see Pegler (1986). Species belonging to the genus *Copelandia* Bres., are very closely related to those referred to *Panaeolus* (Fr.) Quél. However, the species assigned to *Copelandia* have in common a blueing of the fruit-body when bruised, the presence of conspicuous, thick-walled, brown, lanceolate metuloidal cystidia with a rostrate apex, and black-brown, limoniform spores that are lenticular, and have a conspicuous snout-like germ pore.

The genus *Copelandia* has not received universal recognition, and some authorities prefer to assign the species which have been classified in *Copelandia* to *Panaeolus*. For this reason one finds species which are closely related to *C. cyanescens* described in the genus *Panaeolus*. One such species is *Panaeolus tropicalis* O'lah, which comes very close to *C. cyanescens*, differing chiefly in having smaller spores than those of the latter taxon "10.0-12.0 x 7.0-9.0 μm vs 12.0-14.0 x 7.5-11.0 μm." Further, *P. cyanescens* was said to be "4-spored, occasionally 2-spored" (Stamets, 1996). *P. tropicalis* is known from Hawaii, Central Africa and Cambodia.

In some features the South African collection, described above, is intermediate between *C. cyanescens* and *P. tropicalis*. Thus the spores of the South African collection are large and agree with those of *C. cyanescens,* while the basidia are two spored as in *P. tropicalis*. Regarding the basidia of *C. cyanescens,* Stamets (1996) notes the basidia of this species as "4-spored, occasionally 2-spored" - but it is not clear if this refers to basidia on a single fruit-body or lamella, or to basidia of fruit-bodies

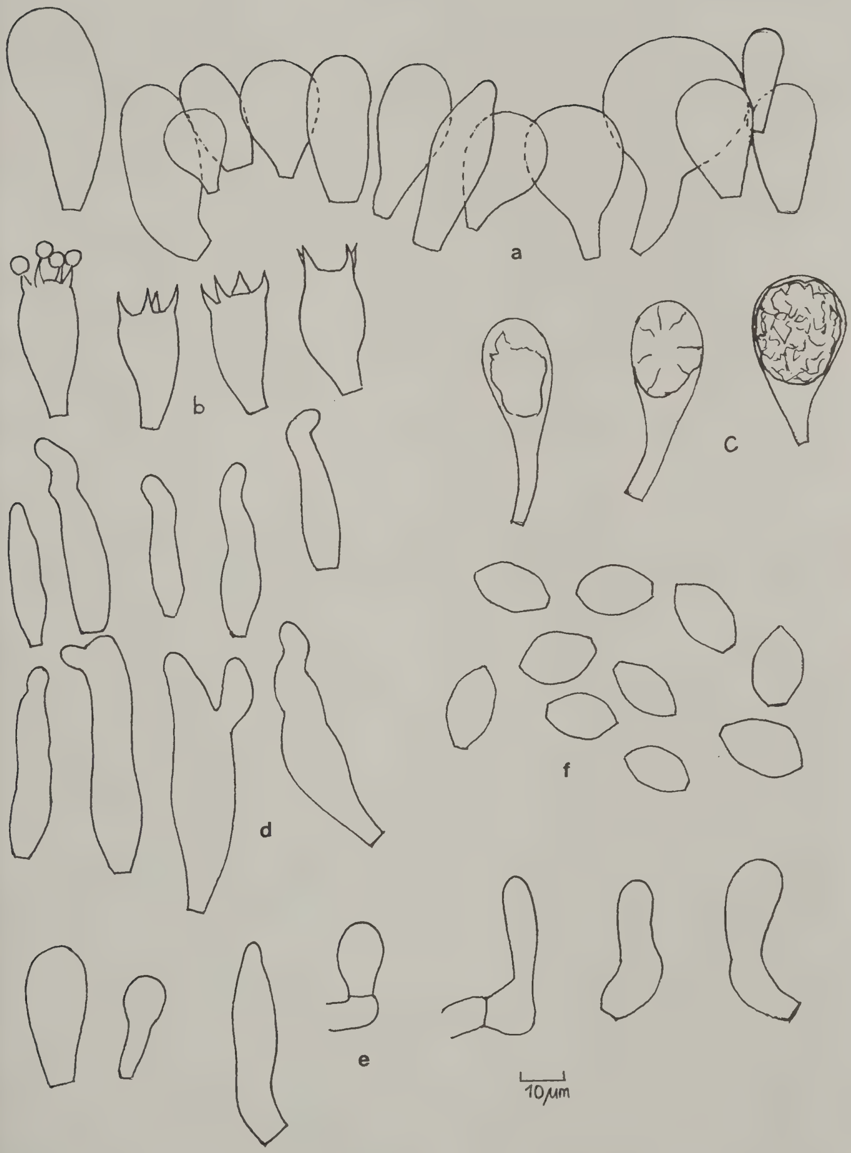

Fig. 6. a-f. *Copelandia cyanescens*. a. Section of pileal surface. b. Cheilocystidia. c. Basidia. d. Metuloidal cystidia on gill face. e. Caulocystidia. f. Spores (All from **PRUM** 3239).

comprising different collections. On balance we attach greater importance to the spore size of our material, than to the number of sterigmata per basidium, and accordingly we have referred our gathering to *C. cyanescens*.

It should be noted that *C. cyanescens* is an hallucinogenic species, and Stamets (1996) notes that it is moderately potent in this respect. He adds that it is "A strong producer of psilocybin and/or psilocin, although highly variable in content.

Panaeolus antillarum (Fr.) Dennis, Kew Bull. **15**, 124, 1961.
Agaricus antillarum Fr., Elench. Fung. **1**, 42, 1828.
Agaricus capnolepis Kalchbr., Grevillea **9**, 132, 1880.
Hypholoma capnolepis (Kalchbr.) Sacc., Syll. Fung. **5**, 1033, 1887.
Panaeolus sepulchralis (Berk.) Sacc., Syll. Fung. **5**, 1119, 1887.
Panaeolus solidipes (Peck) Sacc., Syll. Fung. **5**, 1123, 1887.
Panaeolus ovatus (Cke. & Massee) Sacc., Syll. Fung. **9**, 147, 1889.
Panaeolus teutonicus Bride & Métrod, Bull. Frimest Soc. Mycol. Fr. **66**, 106, 1950.
Panaeolus semiovatus (Sow. Ex Fr.) Lundell Forma *exannulata* Pearson, Trans. Br. Mycol. Soc. **33**, 309, 1950.
Fig. 7 a-f.

Pileus 33-45 mm d., campanulate to convex-campanulate, dirty white, shiny, with underlying marking suggestive of subcutaneous cracking, but on drying there is cracking of the most superfical layer of the pileus to form very thin and inconspicuous scales, which need to be examined under a lens. Margin incurved and bruising dark yellow-brown where the fruit-body has been lying on a table or other surface. **Stipe** 100-150mm long, 7-8mm wide, often enlarged above, or with an apical bulge 8-11mm d., base sometimes slightly tapered, or very slightly enlarged before terminating in a short pseudorhiza, dirty white, bruising yellow-brown on handling, and minutely pruinose to base s.l., also longitudinally striate, especially at the apex, where the coarse striations mark the termination of the lamellae; flesh in stipe solid. **Annulus** lacking. **Lamellae** adnate, greyish buff becoming black, with slightly mottled appearance, and with a strikingly white edge. **Pileal surface** an epithelium of very versiform elements, varying from sphaeropedunculate to subcylindric or subclavate, thin-walled, hyaline, 20-50 x 9-23(34) μm. **Pileocystidia** very occasional, fusoid-lanceolate, thin-walled, hyaline, to 40 x 13 μm. **Pileal context** of thin-walled, hyaline, branched, septate hyphae, 3.3-8.0 μm, which are uninflated, and others which are also thin-walled, hyaline, and very strongly inflated to 66 μm d. - these inflated segments are often rather short, doliiform and constricted at the septa. Clamp-connections were not seen on any of the hyphae. **Cheilocystidia** lageniform, 31-60 μm long, comprising a slightly swollen base, 7-12 (19) μm d., narrowing gradually to an obtusely rounded apex, 3-5 μm wide, sometimes sinuous toward the apex, and occasionally with a short, obtuse, lateral branch. **Pleurocystidia** present as thin-walled, clavate or ovate chrysocystidia, with broadly rounded apex, but tapering below into a long, narrow, stalked base. These elements contain a bright yellow, refractive inclusion in the apical portion; sometimes the entire contents are yellowish, 39-47 x 16-21 μm. **Caulocystidia** abundant, thin-walled, hyaline, very variable in shape and size, from rather small sphaeropedunculate elements, 17 x 10 μm, to lageniform with a swollen base 10-12 μm wide, prolonged above into a cylindrical, rather broad neck, to 7 μm wide, which often

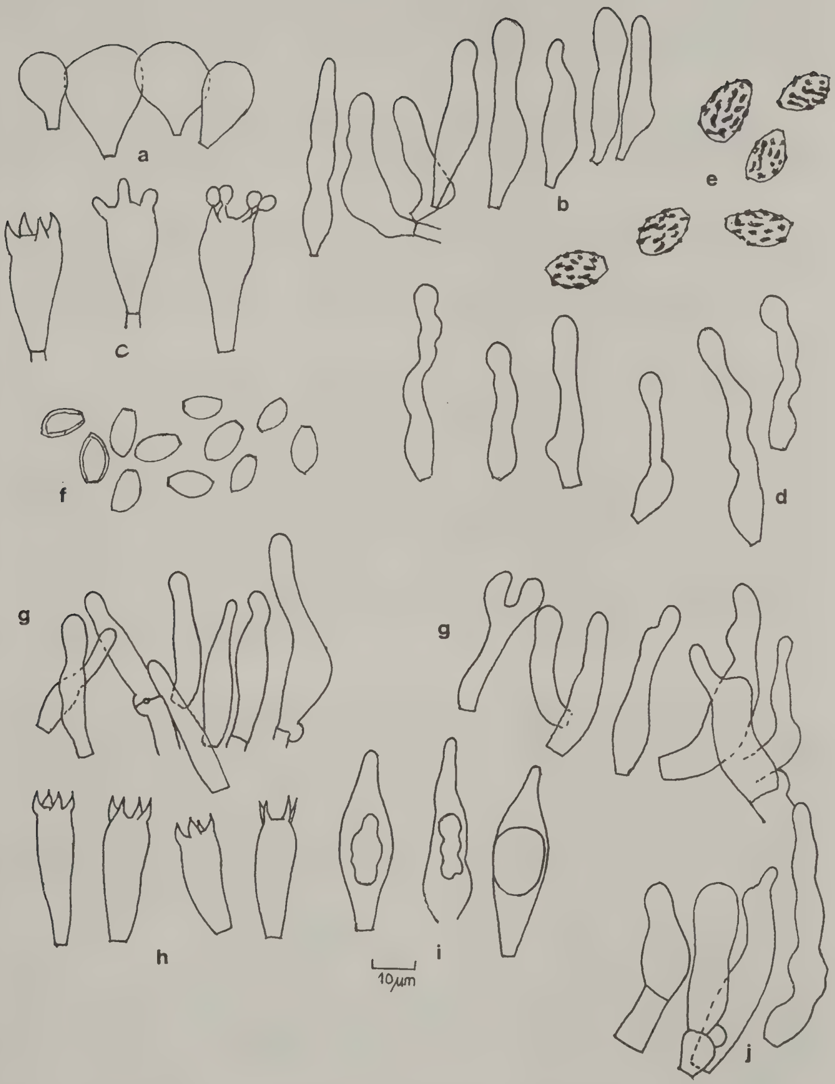

Fig. 7. a-f. *Panaeolus antillarum*. a. Section of pileal surface. b. Basidia. c. Chrysocystidia. d. Cheilocystidia. e. Caulocystidia. f. Spores (All from **PRUM** 4448). f-j. *Stropharia aurantiaca*. f. Spores. g. Cheilocystidia. h. Basidia. i. Chrysocystidia. j. Caulocystidia (All from **PRUM** 2785).

enlarges gradually toward an obtusely rounded apex, 7.5-12.0 μm wide; or occasionally elongate fusoid to 45.0x9.5 μm, or more. **Basidia** thin-walled, hyaline, clavate, 4-spored, 28-32 x 12-13 μm. **Spores** 16.0-20.0 x 9.5-12.2 μm, conspicuously hexagonal, and broadly elliptic, with a dark brown to black, complex, thickened wall and a prominent, papillate, germ pore.

Habitat: Gauteng, Dorinkloof, Centurion, Plot 80, Henco van Vuuren. 13 April 1999. On pile of stable manure. On the farm Grootvlei, near Petronella, Magda Nel, 30 March 1996, on cow dung, **PRUM** 4158.

North West Province: Pilanesburg National Park. D.A. Reid & A Eicker, 13 March 1997. On elephant dung, in exposed sunny situation, **PRUM** 4172.

Southern Cape: Near Vleesbaai, D.A. Reid & A. Eicker, 16 April 1990. On cattle dung, in open pasture, **PRUM** 2884.

Discussion: Reference to the literature shows few previous records of *P. antillarum* from South Africa. Kalchbrenner (1880) published a species with the name *Agaricus capnolepis* Kalchbr., which, following an examination of the holotype in **K**, was shown to be a synonym of *P. antillarum (*Pegler, 1983). Doidge (1950) lists a collection "on a manure heap, Pretoria, Wickens" under the name "*Panaeolus solidipes* Peck", while Pearson (1950) collected it on several occasions on dung, from Cape Town, in April 1948. However, Pearson was struck by the close similarity of his gatherings to *P. semiovatus* (Sow. ex Fr.) Lundell - a widespread annulate species in Northern Europe. Since his South African material consistently lacked a ring, he was led to refer his collections to a superfluous new taxon *P. semiovatus* forma *exannulatus* Pearson.

Apart from South Africa, records from Subsaharan Africa are relatively few. Pegler (1977) listed a number of collections from Kenya, Tanzania and Uganda, including a collection on buffalo dung from the last named country. Pegler (l.c.) also observed "The numerous citations in the literature for this fungus suggest it is a common pantropical fungus", but it is not confined to tropical or subtropical regions, since Watling & Gregory (1987) record it as "uncommon although fairly widespread in grassy places on dung or on freshly manured soil" in the United Kingdom.

P. antillarum is extremely similar in macroscopic appearance to *P. semiovatus*. Both are large coprophilous species with a shiny, dirty white pileus, which is viscid in wet conditions, and both possess chrysocystidia on the gill face. However, whereas *P. antillarum* is exannulate, *P. semiovatus* has a well developed annulus, and whereas the stipe of *P. antillarum* is solid that of *P. semiovatus* is hollow. Also the pileus of *P. semiovatus* tends to be more parabolic, while that of *P. antillarum* tends to be campanulate. Further, the chrysocystidia of *P. antillarum* are larger, more prominent, and possibly more ovoid than those of *P. semiovatus;* and the spores of *P. antillarum* are distinctly hexagonal, with a strongly papillate germ pore; those of *P. semiovatus* are merely described as elogate-elliptic in face- and side views (Watling & Gregory, 1987).

It is interesting to compare the results of our observations on the recent South African collections of *P. antillarum* in **PRUM**, as cited above, with the account of this species published by Pegler (1977) based on collections from East Africa, especially in regard to presence of clamp-connections. Thus Pegler (l.c.) notes "All hyphae with clamp-connexions"; Pegler (1983) also refers to the presence of clamp-connections on the contextural hyphae of material from Central and South America. However, in our study of the most recent South African gathering from Dorinkloof, clamp-connections could not be demonstrated, while in the material from Grootvlei, near Petronella, clamps were noted as "very rare indeed". Further observations are needed to ascertain if there is any correlation between presence and absence of clamp-connections and geographical distribution in *P. antillarum.,* at least in Africa.

Another intersting aspect concerns the substrate utilized by *P. antillarum.* This species is clearly able to grow on dung from a wide range of herbivorous mammals. It has been reported frequently on dung of horses and cattle, and also on that of buffalo, elephant and rhino.

A more complete list of synonyms of *P. antillarum* is given by Pegler (1977, 1983).

Panaeolina foenisecii (Pers:Fr.) Maire, Treb. Mus. Cienc. Nat. Barcelona, **15**, sér. bot. 2, 109, 1933.

Psilocybe foenisecii (Pers:Fr.) Qúel., Mém. Soc. Emul. Montbéliard, Sér. II, **6**, 117 [147], 1872.

Panaeolus foenisecii (Pers:Fr.) Schroeter apud Cohn, Kryptogamen-Flora von Schlesien Pilze **565**, 1889.

Fig. 8 a-e.

A small campanulate brownish grey fungus on lawns. **Pileus** campanulate to convex or semiglobate, not expanding, to 16 mm high, 16 mm wide or more, brownish grey to smoky brown, often more brownish at the centre, and darker, more water-soaked in a narrow zone at the margin after rain, hygrophanous, becoming paler on drying. **Stipe** to 40 mm high, to 1.75 mm wide, pallid, grading from dark brown with a hint of beige at the base, to whitish at the apex, and with a silvery fibrillose surface s.l. **Lamellae** adnate, pale brown at first, becoming darker, blackish brown and mottled, with a pale edge. **Pileal surface** an hymenoderm of thin-walled, hyaline, sphaeropedunculate elements, 15-30 x 10-20 μm. **Lamellar trama** regular. **Cheilocystidia** thin-walled, hyaline, 23-45 μm long, varying from lageniform to utriform, comprising a slightly inflated base, 6.5-8.5 μm wide, narrowed gradually or abruptly above into a neck of variable length, terminating in an obtuse, often slightly enlarged apex, 4-8 μm wide, and narrowed below into a short stipe-like base. **Pleurocystidia** none. **Caulocystidia** at stipe apex, 30-50 μm long, lageniform, similar to cheilocystidia but conspicuously undulating in outline, to almost coiled, comprising a slightly inflated base, 5.5-7.0 μm, prolonged into an elongated sinuous neck, terminating in an obtuse to subcapitate apex, 6.0-6.5 μm wide. **Basidia** 26.0-39.6 x 11.0-14.3 μm, thin-walled, hyaline, clavate, 4-spored. **Spores** 13.0 -17.0 x 8.0-10.2 μm, umber-brown, with a thickened, complex wall, and a blotchy ornament of irregular, sinuous ridges and warts, and with a prominent, almost snout-like, truncate germ pore and minute apiculus.

Habitat: Gauteng: On lawns outside Engineering Building, University of

Pretoria Campus, April 1990, D.A. Reid, **PRUM** 3041; Northern Province: In strip of kikuyu lawn by parking area, Overvaal Spa, Warmbaths, 22 June 1989. A. Eicker & D.A. Reid.

Occurrence and distribution: *Panaeolina foenisecii* is poorly known in South Africa. It has received no mention in either of the recently published field guides to South African Fungi by Levin *et al.* (1985) or Van der Westhuizen & Eicker (1994). However, a number of collections were cited by Doidge (l.c.) under the entry **Psilocybe foenisecii** as follows: Eastern Cape: Somerset East MacOwan 1368 (**PREM** 34758]. Klein Vis River, MacOwan 1323 [**PREM** 20935]. Boschberg MacOwan 1006, 1368b, 1372 [**PREM** 22075]. Free State: Bloemfontein Potts [**PREM** 12969, 12971].

Common and widespread in the northern Hemisphere.

Discussion: The genus *Panaeolina*, including *P. foenisecii* and its allies, is sometimes incorporated into the genus *Panaeolus* (Fr.)Quél., where it is variously accorded the rank of subgenus or section, based mainly on the feature of the spores which possess a characteristic blotchy ornament of irregular ridges and warts.

An interesting observation concerns the presence or absence of clamp connections on the hyphae of *P. foenisecii*. According to Watling & Gregory (1987) clamp connections are "apparently absent" in this species, but clamps were observed in the South African material.

Strophariaceae Overeem ex Singer & Smith
Subfamily Stropharioideae Singer

Hypholoma subviride (Berk. & Curt.) Dennis, Kew Bull. **15**, 134, 1961.
Agaricus subviridis Berk. & Curt. In Journ. Linn. Soc., Bot. **10**, 292, 1869.
Psilocybe subviridis (Berk. & Curt.) Sacc., Syll. Fung. **5**, 1051, 1887.
Naematoloma subviride (Berk. & Curt.) A.H. Smith, Mycologia **43**, 579, 1951.
Agaricus janus Berk. & Br., Journ. Linn. Soc., Bot. **11**, 541, 1871.
Flammula janus (Berk. & Br.) Sacc., Syll. Fung. **5**, 821, 1887.
Hypholoma janus (Berk. & Br.) Petch, Ann. R. Bot. Gdn, Peradeniya **9**, 125, 1924.
Hypholoma papillatum Pat., Bull. Trimest. Soc. Mycol. Fr. **14**, 54, 1898.
Hypholoma flavovirens Murr., Mycologia **10**, 68, 1918.
Pholiota aggregata Beeli, Bull. Soc. Bot. Belg. **61**, 85, 1928.
Fig. 2 i-l.

Sporophores commonly occurring as caespitose clusters on fallen branches, woody debris, stumps, trunks and roots. The fruit-bodies are smallish, greenish yellow, with olive lamellae. **Pileus** (4) 10-23 mm d., shallowly convex, hygrophanous, greenish yellow drying out from the centre, which is slightly more tan-coloured, with the non- striate margin tending to retain a watery greyish appearance. **Lamellae** adnexed or adnate, often with a decurrent tooth, at first yellow, becoming increasingly olive with age; margin pale yellow. **Stipe** 15-25 mm high, 1.0-1.5 mm wide, yellow

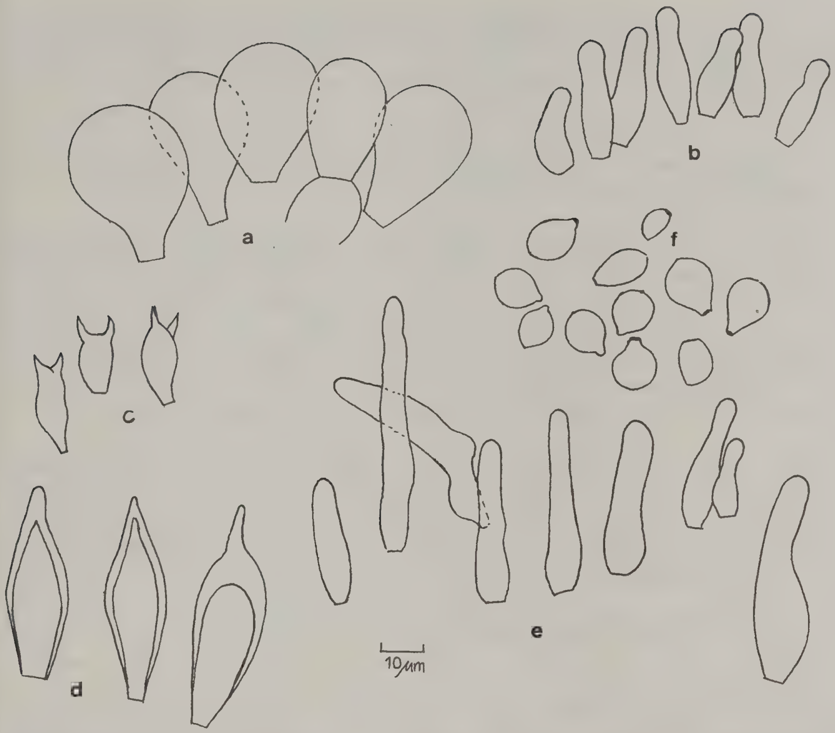

Fig. 8. a-e. *Panaeolina foenisecii*. a. Section of pileal surface. b. Cheilocystidia. c. Basidia. d. Caulocystidia. e. Spores (All from **PRUM** 3041). f-j. *Stropharia aurantiaca*. f. Spores. g. Cheilocystidia. h. Basidia. i. Chrysocystidia. j. Caulocystidia (All from **PRUM** 2785).

with longitudinal fibrils, which leave a cortinate ring zone near the stem apex, often emphasized by the trapped, purple spores. **Context** pale yellow in the pileus and upper stem, darkening to tan in stipe base. **Pileipellis** a cutis of repent hyphae, 3-8 (9) µm d., which are more densely compacted than the hyphae of the context, and like them bear clamp-connections at the septa, and are finely encrusted. **Pileal context** of thin-walled, pale yellowish, clamp bearing hyphae, yellowish in the mass, and 6.0-19.8 µm wide, branched, septate, with clamps, and densely interwoven. **Stipitipellis** of vertical hyphae 2-13 µm d., with thin or distinct walls and bearing clamps at the septa. These hyphae appearing yellowish in the mass. **Lamellar trama** regular of thin-walled, clamp bearing hyphae, 3.0-13.2 µm d. **Cheilocystidia** 12-25 µm long, lageniform to subcylindric, often with a slightly enlarged base, 4.0-5.5 (7.2) µm wide, prolonged above into a broad neck terminating in an obtuse apex, 4.5-5.0 µm wide, which may sometimes be almost capitate; walls thin or sometimes rather distinct. **Pleurocystidia** 19-30 x 10-11 µm, present but scanty, as ovate or lanceolate chrysocystidia, with refractive yellowish contents which stain deeply in cotton blue. **Caulocystidia** not seen. **Basidia** 19-25 x 4-5 µm, thin-walled, hyaline, 4-spored, varying from cylindric to clavate, sometimes slightly sinuous, or with slight subterminal constriction. **Spores** 5.0-6.5 x 3.0-4.2 µm, ellipsoid to pip-shaped, with smooth, thickened, brown walls, and an apical germ pore. **Spore print** purple.

Habitat: On roots and buried twigs along forest track, Kloof Nature Reserve, KwaZulu-Natal, D.A. Reid & A. Eicker, 24 March 1998, **PRUM** 4364. Additional collection: Mt Sullivan, Port St Johns, Kwa-Zulu-Natal, A.E. van Wyk, 12 April 1990 **PRUM** 4311.

Distribution. In South Africa this species is known only from the two collections cited above, both from KwaZulu-Natal.

Discussion: *Hypholoma subviride* has a wide distribution in tropical and subtropical areas of the world, having been reported from both the neo- and paleotropics (Pegler 1977, 1983, 1986). Numerous collections are known from East Africa, and Pegler (1977) cites collections from Sri Lanka. Further Pegler (1983) noted that *H. subviride* occurs frequently throughout the Caribbean area and lists gatherings from Martinique, Guadeloupe, Dominica, Trinidad and Cuba - the last named country being that from which the holotype of *H. subviride* was originally collected.

H. subviride is extremely closely related to *H. fasciculare* (Huds.: Fr.) Kummer, which is itself a widely distributed species, especially in the northern temperate zone. *H. subviride* differs only in its smaller, less robust fruit-bodies and in having consistently smaller spores. As Pegler (1977) observes *H. subviride* represents little more than a tropical state of *H. fasciculare.*

Pegler (1983,1986) gave a more detailed synonymy.

Stropharia aurantiaca (Cooke) P.D. Orton, Trans. Br. Mycol. Soc. **43**, 181, 1960.
Agaricus squamosus forma *aurantiacus* Cooke, Handbook of British Fungi. Ed III, **199**, 1883-91.
Stropharia squamosa var. *aurantiaca* (Cooke)Mass., British Fungus Flora **1**, 402,1892.
Stropharia percevalii var. *aurantiaca* (Cooke) Sacc., Syll. Fung. **5**, 1016, 1887.
Fig. 8 f-j.

A bright orange-red fungus with caespitose growth form, occurring on composted soil or wood chips used as a garden mulch. **Pileus** 20-60 mm d., at first campanulate, expanding to shallowly campanulate, sometimes with an obtuse umbo, finally becoming flattened or even slightly concave, hygrophanous, young pilei moist to slightly viscid, older pilei dry with a shiny surface, commencing orange-red, or rich reddish brown, drying out paler from the centre, and finally becoming dull reddish brown. In age the pileal surface sometimes becomes radially fissured toward the margin; margin at first incurved, with prominent whitish fibrillose remnants of the veil, which may leave appendiculate fragments, or a zone of whitish remnants just in from the margin. **Stipe** 40-80 mm tall, 2.5-3.5 mm wide, tall cylindrical, equal, hollow, creamy white except at the reddish brown base, the surface covered by longitudinal, cottony, white fibrils, which may disrupt in bands; surface bruising reddish brown on handling; no ring or annular zone on the stipe. At the base of the stipe there are whitish rhizomorphs which penetrate the surrounding soil. **Lamellae** initially greyish, then clay brown and finally dark brown, adnate with a tooth, or adnexed with an inconspicuous tooth, causing the apex of the stipe in some specimens to appear indistinctly striate.

Flesh: either creamy white in pileus and upper part of stem, becoming increasingly golden red-brown below, or orange-brown throughout and slightly darker in the stipe. **Smell** not distinctive. **Pileal surface** with a separable, viscid pellicle. A section shows a superficial layer of - presumably - gelatinized hyphae, though gelatinization is not very evident. The superficial hyphae, 2.0-3.3 μm wide, are thin-walled, hyaline, scantily branched, without directional orientation, and with clamp-connections at the septa; the terminal elements of these hyphae are slightly clavate. Beneath this superficial layer is a deeply pigmented zone, having an almost parenchymatous appearance, comprising hyphal segments, which have rounded up to form doliiform to globose or subglobose, thin-walled elements, with conspicuous plaques of encrusting pigment. These inflated elements to 30 μm wide. In the lower regions of this zone there are normal, branching, septate hyphae, with clamp- connections, and with bands of encrusting pigment. **Velar remnants** on pileal margin formed of hyphae 4.0-6.6 μm wide, with thin to distinct walls, and with clamp- connections at the septa. Silvery fibrils on surface of stipe, formed of hyphae rather similar to those constituting the veil ie. 3.3-6.0(-8.0) μm wide, septate, scantily branched and bearing clamp-connections at the septa, and with thin to rather distinct walls. **Stipitipellis** a layer of parallel, vertical hyphae, 1.6-3.5 μm wide, with distinct, slightly thickened walls and bearing clamp-connections at the septa, internal to these surface hyphae are others, thin-walled, hyaline, septate up to 9 μm wide. **Cheilocystidia** very abundant, forming a very conspicuous sterile edge to the lamellae, 25-45 x 5-7 μm, thin- walled, hyaline, lageniform, with a slightly enlarged base, 6-7 μm wide - exceptionally inflated to 10 μm wide, narrowing gradually above into a somewhat sinuous neck, 2.5-4.0 μm wide, terminating in an obtuse apex, which is sometimes slightly inflated, 4-6 μm wide. **Chrysocystidia** scattered over the lamellar face, 40(-50) x 10-11(-16) μm, thin-walled, hyaline, fusoid to lanceolate, or sometimes clavate, with a refractive inclusion; these organs stain in cotton blue. **Caulocystidia** in tufts at the stipe apex, thin-walled, hyaline, initially ovate, about 25 x 10 μm, but developing into lageniform elements, 22-55 μm long, comprising a slightly to distinctly swollen base, 6-11(-12) μm wide, extended above into an elongated neck 4-7 μm wide, often sinuous toward the tip, and terminating in an obtuse apex, 2.5-6.0(-9.0) μm wide, very occasionally subcylindric. It is not unusual for some of these elements to develop a short lateral branch; others become 1-septate toward the base, with the septum bearing a clamp-connection. **Basidia** 24.0-33.0 x 8.2-10.0 μm, thin-walled, hyaline, clavate, 4-spored. **Spores** 10.0-12.0 x 6.0-6.5 μm, ellipsoid in side view, to subamygdaliform in surface view, with thickened, brown wall, an apical germ pore and an indistinct apiculus. Spore print dark brown, but not purplish although purplish in some collections from the same locality.

Habitat: Gauteng: In compost-rich soil, of heavily shaded shrubbery, under tall trees with dense canopy, Botanic Garden, University of Pretoria Campus (behind car park), 28 June 1989. A. Eicker, **PRUM** 2785; KwaZulu-Natal: Under exotic and native bushes, near chalets, Giants Castle Camp site, Drakensberg, 19 February 1993, D.A. Reid & A. Eicker, **PRUM** 3602.

Distribution: In Levin *et al.* (1985) the distribution of *S. aurantiaca* is given as "occasional, South Western Cape". Van der Westhuizen & Eicker (1994) confirm this observation and add that it has also been recorded from the eastern Transvaal (Mpumalanga). Taken with our own records (see above) it seems that the species is widespread, if sporadic, in its occurrence in South Africa, where it has probably been introduced.

Stropharia aurantiaca is widespread in Europe, and is becoming more frequent as the mulching of flower beds and shrubberies with shredded bark and wood chips by gardeners, is now common place. It is recorded from Japan, and is also known from Australia under the name *Psilocybe ceres* Cleland (Watling & Gregory, 1987).

Discussion: *Stropharia aurantiaca* is readily recognised by its bright orange-red fruit-bodies, usually growing in caespitose clusters or densely gregariously, on wood chips and shredded bark applied as mulch to flower beds. In the United Kingdom the abundance of this fungus on flower beds mulched in this manner, is often such that the fungus may be responsible for a more spectacular display of colour than that provided by the gardeners choice of flowering plants.

Illustrations: Levin *et al.* (1985) P. 76 - too delicate and solitary; Van der Westhuizen & Eicker (1994) P118 - too delicate and solitary; Phillips (1981) P172 - good.

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Literature cited

Doidge, Ethel M. 1950. South African Fungi and Lichens to the end of 1945. *Bothalia* 5: 1-1094.

Grünert, H. & R. (1991). Field Guide to Mushrooms of Britain and Europe. Crowood Press Ltd. Pp288

Kalchbrenner, K. 1880. Fungi MacOwaniana. *Grevillea* 9: 107-116, 131-137.

Levin, H., Branch, M., Rappoport, S. & Mitchell, D. 1985. A field guide to the Mushrooms of South Africa. Struik. Cape Town.

Lincoff, G.H. 1981. The Audubon Society Field Guide to North American Mushrooms. Knopf. New York.

Orton, P.D. & Watling, R. 1979. British Fungus Flora. Agarics and Boleti. 2. Coprinaceae. Part 1. *Coprinus*. Her Majesty's Stationery Office, Edinburgh.

Pacioni, G. 1985. The Macdonald Encyclopedia of Mushrooms and Toadstools. Macdonald, London & Sydney.

Pearson, A.A. 1950. Cape Agarics and Boleti. *Trans. Brit. mycol. Soc.* 33: 276-316.

Pegler, D.N. 1983. Agaric Flora of the Lesser Antilles. Kew Bulletin Additional Series IX. Her Majesty's Stationery Office. London.

Pegler, D.N. 1986. Agaric Flora of Sri Lanka. Kew Bulletin Additional Series XII.

Pegler, D.N. 1977. A preliminary Agaric Flora of East Africa. Kew Bulletin Additional Series VI. London. Her Majesty's Stationery Office. London.

Phillips, R. 1981. Mushrooms and other fungi of Great Britain and Europe. Ward Lock Ltd. London.

Reid, D.A. & Eicker, A. 1998. South African Fungi 8. Three new species of *Hymenagaricus* from South Africa, with a revised key to South African taxa.

South African Journal of Botany 64(6): 356-360

Stamets, P. 1996. Psilocybin Mushrooms of the World. An identification guide. Ten Speed Press. Berkeley, California.

Van der Westhuizen, G.C.A. & Eicker, A. 1994. A Field Guide. Mushrooms of Southern Africa. Cape Town: Struik Publishers (Pty) Ltd.

Watling, R. & Gregory, N.M. 1987. British Fungus Flora. Agarics and Boleti. 5. Strophariaceae & Coprinaceae p.p. Her Majesty's Stationery Office. Edinburgh.

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REVISION OF *PHYSCIA LACINULATA* MÜLL. ARG. (PHYSCIACEAE, LICHENIZED ASCOMYCOTINA)

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Abstract *- Originally described as phyllidiate,* ***Physcia lacinulata*** *Müll Arg. appears as a species with the ability to produce also primary and secondary soralia. Field studies indicate that, in open habitats, the phyllidiate condition may become totally obscured by the formation of secondary soralia. First, the phyllidia either become detached or they disintegrate into soredia; then, soredia formed inside the thallus liberate through phyllidia scars, which therefore develop into secondary soralia. Revision of the type specimens of* ***P. lacinulata*** *and* ***P. albata*** *(Wilson) Hale demonstrated that the Argentine sorediate material referred to the latter species belong to* ***P. lacinulata****. Both taxa share the following features: thin, fragile thallus producing laminal, punctiform, primary soralia, pale underside, and medulla with atranorin and triterpenoids. However,* ***P. lacinulata*** *exhibits smaller thalli, narrower lobes, marginal and laminal phyllidia which may develop into secondary soralia, K- to K+ medulla, and subparaplectenchymatous lower cortex. The concept of this species is emended. The key to the* ***Physciae*** *from Buenos Aires Province is modified. A standard method for analyzing lobe features is given.*

INTRODUCTION

Physcia (Schreb.) Michaux is one of the most problematic genera among foliose Physciaceae, at least in Argentina. Although Central and South American species were recently revised by Moberg (1990; ca. 30 species treated, eleven of them new to science), some difficulties in species delimitation remain. Unfortunately, Moberg (1990) included comments on morphological variation of species but did not include lists of specimens examined for most of the problematic taxa.

According to the present knowledge, the species of ***Physcia*** producing phyllidia seem to be restricted to Central and South America. In the present paper, ***Physcia lacinulata*** Müll. Arg. is revised. It is shown as a species of variable morphology, producing primary and secondary soralia in addition to phyllidia. Argentine material provisionally identified as ***P. albata*** (Wilson) Hale (Scutari 1992b; 1995b) is referred here to ***P. lacinulata***, the only phyllidiate species of ***Physcia*** known from Argentina.

MATERIALS AND METHODS

Specimens examined include Argentine material collected by the author, some of them previously referred to as ***Physcia albata*** (Wilson) Hale (deposited in BAFC, CTES, NDA and the author's private herbarium), the type specimens of ***Parmelia albata*** Wilson (MEL) and ***Physcia lacinulata*** Müll. Arg, (G), and further material at UPS. Thallus morphology and anatomy were analyzed by light microscopy. For elucidating lobe branching and width, as well as shape and width of lobe apices, camera lucida drawings of lobes were made. Lobes were defined according to the following criteria (Fig. 1): **a)** a presumed lobe is the thallus segment above the last sharp subdichotomy; and **b)** a thallus segment is considered as a single lobe when the distance from the last sharp subdichotomy to the next axil (d_{ax}) is much lower than the distance from the last sharp subdichotomy to the apex (d_{ap}), that is, $d_{ax} < 1/4\ d_{ap}$. Thallus segment in Fig. 1A is considered as composed of two lobes, L_1 and L_2 ($d_{ax} < 1/4\ d_{ap}$). Similarly, thallus segments in Figs. 1B and 1D are composed by two and eight lobes, respectively. According to Stearn (1996), three types of lobe apices were defined (Fig. 2): **a) lobed apex:** d_{ax} higher than 1/2 d_{ap}; **b) split apex:** d_{ax} approximately 1/2 d_{ap}; and **c) parted apex:** d_{ax} lower than 1/2 and higher than 1/4 d_{ap}. Apex of lobe L_1 (Fig. 1A) is considered as lobed ($d_{ax} > 1/2\ d_{ap}$), being composed of three segments or lobules (a + b + c). Width of lobes (*w*) was measured by recording the width at the axil just above the corresponding subdichotomy, in right angle to the main lobe axis (Fig. 1B). Width of lobe tips (*Ax*) was considered as the maximum width of the entire, lobed, split or parted lobe segment above the last sharp subdichotomy, in right angle to the axis of mother lobe, and independently of symmetry of the so delimited segment (Fig. 1B). Irregular lobes were not measured (Fig. 1C). Thallus sections were

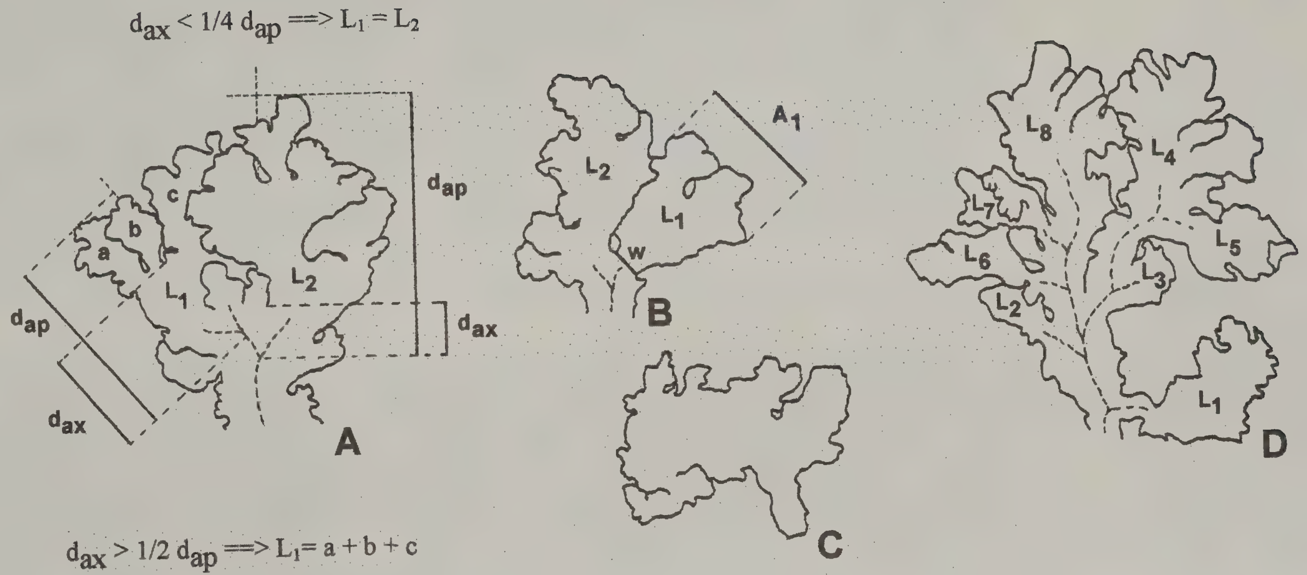
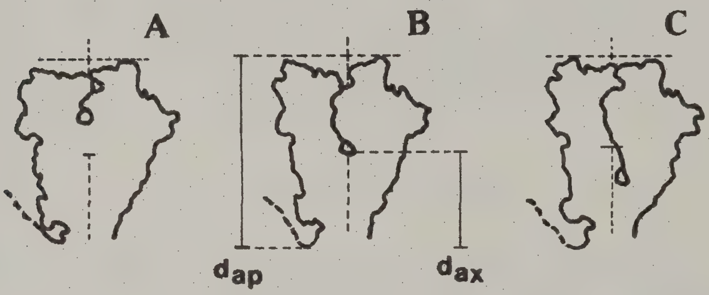

$d_{ax} < 1/4\ d_{ap} \Longrightarrow L_1 = L_2$
c
b
a
L_1
L_2
d_{ap}
d_{ax}
d_{ap}
d_{ax}
A
$d_{ax} > 1/2\ d_{ap} \Longrightarrow L_1 = a + b + c$
L_2
L_1
w
A_1
B
C
L_8
L_4
L_7
L_6
L_5
L_3
L_2
L_1
D

Fig. 1. A. Criteria for distinguishing lobes (*Lx*); d_{ax}= distance from the last sharp subdichotomy to the next axil; d_{ap}= distance from the last sharp subdichotomy to the apex. **B:** criteria for measuring width of lobes (*w*) and lobe apices (A_1). **C:** example of irregular, small thallus. **D:** example of regularly branched thallus. (Simplified drawings: neither soralia nor minute, dissected phyllidia are shown).

made with a rotatory microtome (ca. 11-12 µm thick) and stained with safranin/fast-green according to the method described in earlier papers (Scutari 1990, 1995a). Spot tests on the upper surface of the thallus and medulla were performed with *K* (10% KOH aqueous solution). Identification of lichen substances was made following current TLC techniques (Culberson & Kristinsson 1970; Culberson 1972; White & James 1985).



lobed ($d_{ax} > 1/2\ d_{ap}$) split ($d_{ax} = 1/2\ d_{ap}$) parted ($1/2\ d_{ap} < d_{ax} < 1/4\ d_{ap}$)

Fig. 2. Types of lobe apices (adapted from Stearn, 1996). For further references see lobe L_1 in Fig. 1 B and the explanation in the text.

RESULTS

Specimens referred to ***Physcia lacinulata*** by Müller Argoviensis (1891) are three, and share the following macroscopic features: thin, fragile thallus, whitish underside, and K+ yellow medulla. The lectotype (Pittier n° 5064; selected by Esslinger, 1978) is distinctly phyllidiate, with both marginal (more abundant) and laminal phyllidia (Fig. 3 A, B). A few initials of laminal soralia are observed, apparently developed from phyllidia scars. Unfortunately, characters related to thallus periphery are hardly observed (incomplete specimen). Hence, neither lobe nor anatomical features could be examined. One of the syntypes (Pittier n° 5063) is quite close to the lectotype, while the other specimen (Pittier n° 5065) exhibits marginal, linear, labriform to undulate soralia (Fig. 3 D), few laminal, rudimentary phyllidia, a marginal phyllidium dissolving into soredia, and some laminal, punctiform

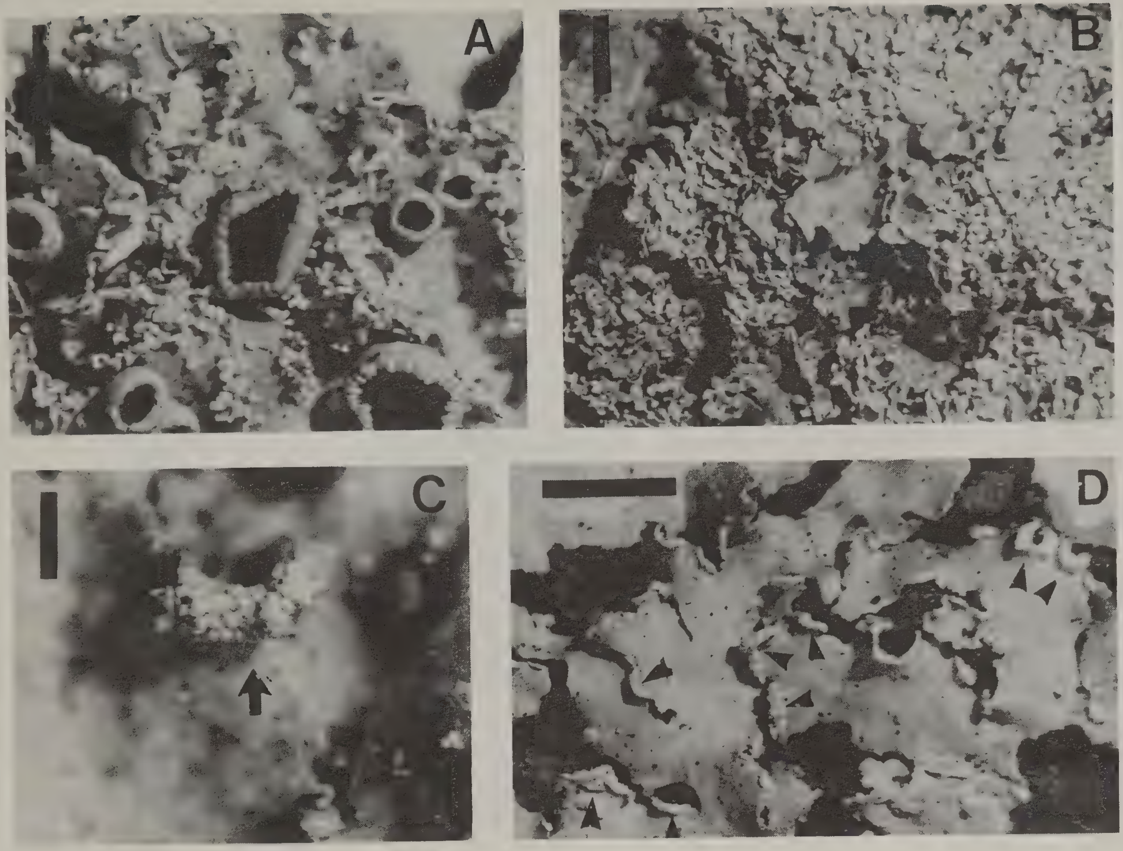


Fig. 3. A-B: lectotype of ***Physcia lacinulata*** Müll. Arg. (Pittier n° 5064; G); note the abundant marginal and laminal phyllidia. **C:** a phyllidiate-sorediate specimen from Entre Ríos Province (BAFC 37890), showing the underside of marginal, revolute phyllidia dissolving into soredia (arrow), an early stage in the development of secondary soralia. **D:** general view of the sorediate syntype, with marginal, probably secondary soralia (Pittier n° 5065; G). Scales: **A, B, D=** 1.5 mm; **C=** 0.5 mm.

soralia. As illustrated in Fig. 4, the lower cortex is composed mostly by leptodermatous to mesodermatous, isodiametric cells of variable diameter (smaller than cells in the upper cortex). Elliptic to short cylindrical cells were also observed, along with cylindrical-celled, leptodermatous hyphae (somewhat thicker than medullary hyphae) which are periclinally arranged in the uppermost layers. Hence, the structure of the lower cortex is here referred to as subparaplectenchymatous (cf. Scutari 1992a,c; 1995a). Lobe width was measured mostly on the syntypes (up to 1.9(-3.4) mm). The lectotype and syntype n° 5063 have numerous, well developed apothecia (up to 2.3 mm diam.), with spores of the *Pachysporaria*-type rather uniform in size: (14.6-)17.9-21.2(-24.5) x (6.5-)8.1-9.8 µm (ten spores measured). Old yellow spots were observed in exposed areas of the medulla. Atranorin and zeorin were reported as main lichen substances by Esslinger (1978).

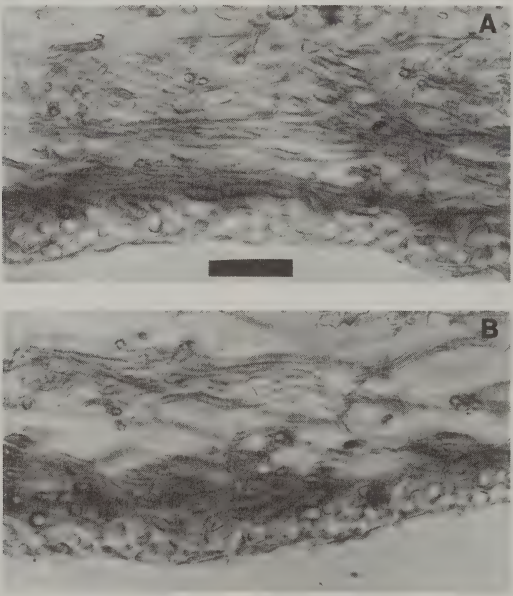


Fig. 4. ***Physcia lacinulata*** Müll. Arg., subparaplectenchymatous lower cortex (from one of the syntypes, Pittier n° 5063). Scale: **A(=B)=** 20 µm.

The Argentine material examined here is divided into two groups: **a)** phyllidiate-sorediate specimens, coming from Diamante

National Park (Entre Ríos Province), Otamendi (Buenos Aires Province), and Martín García Island (Río de la Plata estuary); and **b)** sorediate specimens, from Martín García Island and the University Campus Park in Corrientes city (Corrientes Province).

In addition to phyllidia, specimens of the first group exhibit primary and secondary, laminal, punctiform soralia, as well as secondary, marginal soralia (Fig. 5 A-D; Fig. 3 C). The material from Entre Ríos was excellent for improving the method of measuring lobes. It was collected in a gallery forest typical of Paraná River, in the northern limit of its delta, on branches of ***Celtis tala,*** mixed with ***Candelaria concolor***, ***Hyperphyscia*** spp., ***Leptogium azureum***, ***Physcia atrostriata,*** Opegraphaceae and hepatics. Only one specimen was fertile (herb. Scutari 161C), with apothecia up to 0.7 mm diam., spores of the *Pachysporaria*-type, (14.6-)17.9-21.2 x (6.5-)8.1-9.8 µm, sometimes with sporoblastidia. Atranorin and zeorin were main substances (TLC). The medullary K reaction varied from positive (central parts of the thallus) to negative (peripheral parts). Occasionally, the underside of lobe apices turned yellow with K. Additional specimens come from north-eastern Buenos Aires, close to the coast of Paraná de las Palmas River (herb. Scutari 231A), and Martín García Island, in the seasonal flowing water zone of the coastal forest, close to the old wooden pier, on ***Erythrina crista-galli*** (BAFC 36745; the only phyllidiate specimen collected in the island).

Concerning the sorediate specimens, those from Martín García Island had been previously referred to as ***Physcia albata*** (Wilson) Hale (Scutari 1992b; 1995b). They were growing in an open site close to the harbor, on trunks of isolated ***Ficus monckii*** trees, and exhibit thin, fragile thalli, pale underside, primary laminal, punctiform to crateriform soralia (Fig. 6) forming patches by coalescence, lower cortex of variable structure (paraplectenchymatous with cylindrical cells either in the uppermost layers and/or interrupting the paraplectenchyma), atranorin and triterpenoids. As illustrated (Fig. 5 E-F), there are also marginal soralia, the importance of which for identification is commented below (see Conclusions). An additional collection comes from a suburban habitat in Corrientes City, on ***Schinopsis*** sp. It exhibits only laminal, punctiform soralia. All other features are as described above.

The revision of the type and additional material of ***Physcia albata*** demonstrated that the species is characterized by large, thin fragile thalli, very broad lobes, laminal, punctiform soralia, K+ yellow medulla, and paraplectenchymatous lower cortex.

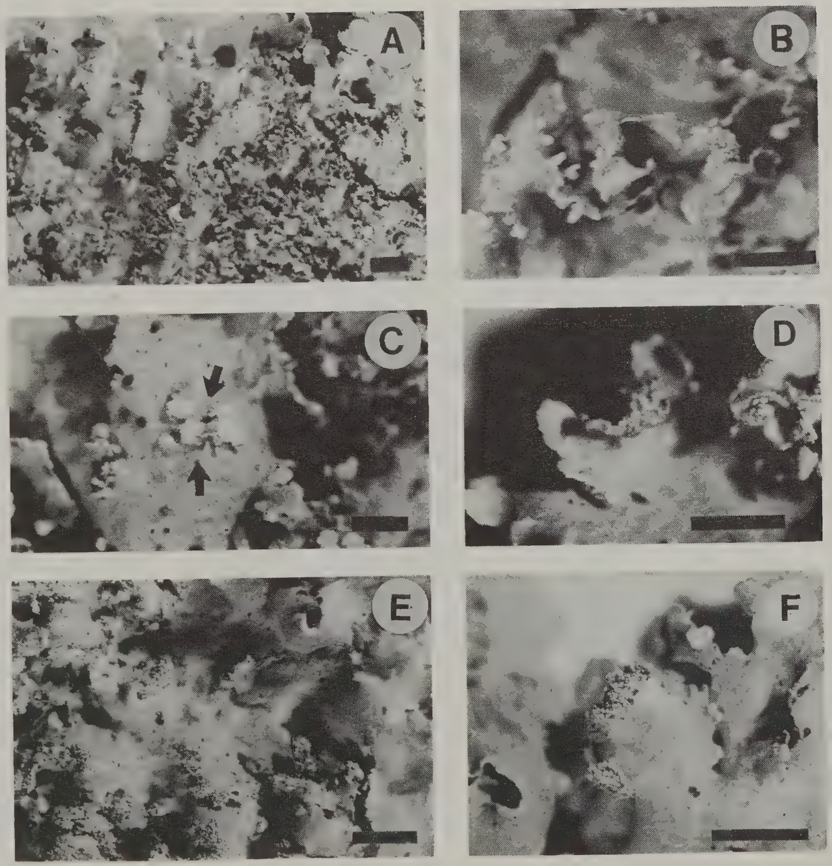


Fig. 5. Argentine specimens. **A-D:** phyllidiate-sorediate material (BAFC 37890). **E-F:** a sorediate specimen (BAFC 35895). **A-B:** marginal phyllidia. **C:** laminal, primary soralia. **D:** marginal phyllidia dissolving into soredia, an early stage in the development of marginal, secondary soralia (BAFC 37890).**E-F:** marginal, secondary soralia. Scales: **A-B, E-F** = 1.5 mm; **C-D** = 0.5 mm.

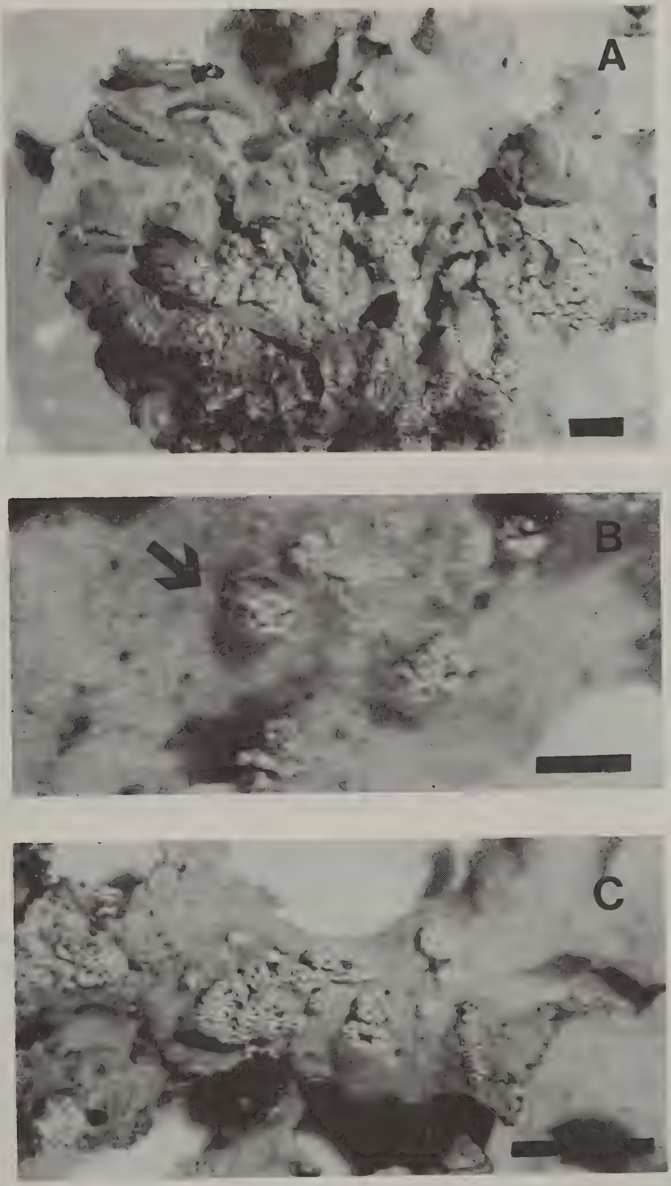


Fig. 6. Argentine sorediate specimen (BAFC n° 35895): **A:** general view. **B-C:** different developmental stages of primary, laminal soralia. Scales: **A, C** = 1,5 mm; **B** = 0.5 mm.

DISCUSSION

P. lacinulata was originally described as phyllidiate (Müller Argoviensis 1891). However, although there is no reference to soralia in the diagnosis, one of the syntypes differs significantly by the absence of phyllidia and the presence of well developed marginal soralia of hidden ontogeny. Moberg (1990), the first who revised the species, commented that some specimens may exhibit laminal soralia, and suggested that the formation of soralia could be induced by moist habitats, from phyllidia scars. This is what I call "secondary soralia", that is, soralia which do not originate by the pressure of soredia developing inside the thallus but from a previous opening in the cortex, e.g. isidia scars, pseudocyphellae, etc. (cf. Scutari 1992a).

The information on thallus structure given in the diagnosis (Müller Argoviensis 1891) is sparse ("... Stratum corticale parenchymaticum ***Physciae*** ..."). Moberg (1990) described the upper cortex as paraplectenchymatous and the lower cortex as "paraplectenchymatous with thick-walled, irregular cells". According to my observations on the syntypes, the lower cortex is composed by cells of irregular shape and size, most of them isodiametric and mesodermatous. But cylindrical-celled hyphae are observed either in the interface with the medulla (Fig. 4; referred to as "subparaplectenchymatous of the type 2" by Scutari, 1992a-c, 1995a) or, less frequently, interrupting the prevailing paraplectenchyma [referred to as "interrupted paraplectenchyma" (Thomson 1963) or "subparaplectenchymatous of the type 1" (Scutari op. cit.)].

In relation to spores, the variation registered here is somewhat smaller than the range given by Moberg (1990).

Although Moberg (1990) did not cite specimens examined except for the lectotype, he reported ***P. lacinulata*** for mountain regions of Ecuador, Guatemala and Venezuela (600-2000 m alt.). Such material was not available at the time of preparing this paper. Nevertheless, the Argentine specimens here examined were very useful to understand this taxon. It was observed that, in open habitats, phyllidia tend to disappear, dissolving into soredia. Then, both marginal and laminal soralia develop from phyllidia scars. True primary, laminal soralia are also formed. Thallus structure and chemistry agreed with that of the syntypes of ***P. lacinulata***. Concerning chemical features, atranorin and zeorin were always detected as major substances, regardless sometimes the medulla gave a negative K reaction. Since the thalli are very thin, this may be a consequence of a complete removal of the medulla and, probably, atranorin is always present throughout the medulla, like in the other species of ***Physcia*** producing triterpenoids.

P. lacinulata was regarded by Moberg (1990) as the phyllidiate counterpart of ***P. albata*** (sorediate) and ***P. dilatata*** Nyl. (lacking vegetative propagules). However, the latter two species are characterized by the paraplectenchymatous lower cortex and, along with ***P. pachyphylla*** Müll. Arg., are the ***Physciae*** with largest thalli and broadest lobes. In my opinion, ***P. lacinulata*** differs from ***P. albata*** and ***P. dilatata*** by the smaller thallus, the narrower lobes and the subparaplectenchymatous lower cortex. It is interesting that the phyllidiate species of ***Physcia*** are few, and known only for Central and South America. In Table 1, ***P. lacinulata*** is compared with the other phyllidiate taxa.

When measuring the width of lobes and lobe apices, problems arose. Thalli were usually irregular, and lobe branching was subdichotomous, irregular to occasionally pinnate (most likely, by development *in situ* of marginal phyllidia). Lobes had broadened, irregularly lobed to parted, often asymmetric apices. In addition, lobe margins were, at least in part, irregularly crenulate, crenate, undulate, sorediate or lobulate, with scarce to numerous, simple to dissected, mostly ascending phyllidia. Unfortunately, Moberg (1990) did not indicate the criteria for defining and measuring lobes. Since I obtained different ranges for ***Physcia lacinulata*** as well as for other species, it became evident that our criteria differed.

CONCLUSIONS

Soralia in the type material of ***P. lacinulata*** Müll. Arg. are interpreted as secondarily formed, developed from phyllidia scars. The species is considered as exhibiting three kinds of soralia: **a)** true, primary, laminal soralia, initially punctiform (similar to those of ***Physcia albata***), scarce to moderate, rarely absent; **b)** secondary, laminal soralia, developed from phyllidia scars after removal and/or disintegration of phyllidia into soredia; and **c)** secondary marginal soralia, also formed from phyllidia scars. It must be stressed that sometimes phyllidia may be almost absent: it was observed that open habitats, more exposed to wind and light, favor the dissolution of phyllidia into soredia as well as the subsequent development of secondary soralia. Concerning the lower cortex, it is not paraplectenchymatous but subparaplectenchymatous.

Table 1. ***Physcia lacinulata***, and the other phyllidiate ***Physciae*** (extracted from Moberg, 1990).

	P. lacinulata	*P. lobulata*	*P. manuelli*
Thallus	irregular to suborbicular, up to 3.5 cm; thin, < 150 µm, fragile	mostly irregular, patches to 5 cm; thin, < 150 µm	± orbicular, to 5 cm; fragile
Upperside	emaculate, epruinose	emaculate, epruinose	sometimes maculate, epruinose
Underside	pale	dark	pale
Lobes	to 1.5(2.6) mm wide; tips irregularly widened, lobed to parted, 2.5-7.4 mm	usually < 0.5 mm wide	to 2 mm (usually 1mm wide), with crenate tips
Medulla	K- to K+ yellow	K+ yellow	K-
Lower cortex	subparaplectenchymatous	paraplectenchymatous	prosoplectenchymatous, lowermost part thick-walled, +/- paraplectenchymatous
Phyllidia	marginal and laminal, simple to dissected	marginal, ascending, often covering inner parts	marginal, in central parts; along with isidia
Soralia	laminal; marginal (secondary)	absent	secondary, rare
Apothecia	except for Argentine material, up to 2 mm diam., common, brown to almost black, discs rarely pruinose, margins usually crenate to crenulate	± common	common, discs black, with white pruina
Spores	*Pachysporaria*-type, often with apical sporoblastidia, (14.6-)17.9-22.8(-24.5) x (6.5-)8.1-9.8 µm, sometimes with sporoblastidia	*Pachysporaria*-type, sometimes with apical sporoblastidia, (27)30-35(40) x (12-)13-16(-18) µm	*Pachysporaria*- or similar to *Physcia*-type, (18)20-23(25) x 9-11(12) µm
Distribution	Argentina, Costa Rica, Ecuador, Guatemala, Venezuela	Costa Rica, Venezuela	Dominican Republic, Venezuela

The presence of marginal soralia had been disregarded for identification of the Argentine sorediate material here re-examined. Such specimens, previously referred to as ***P. albata*** because of their thin, fragile thalli, pale underside, laminal, punctiform soralia, and atranorin and triterpenoids as medullary substances (Scutari 1992b; 1995b) belong to ***P. lacinulata***. It differs from ***P. albata*** (Wilson) Hale only by the smaller thallus, the narrower lobes, the presence of phyllidia and secondary marginal soralia, and the subparaplectenchymatous nature of the lower cortex. ***P. albata*** is still unknown in Argentina, and ***P. lacinulata*** is here reported for Argentina for the first time. Accordingly, the key to the ***Physciae*** from Buenos Aires (Scutari 1992b) is modified as follows:

7 With marginal and/or laminal phyllidia, laminal, punctiform soralia, and/or marginal soralia .... ***P. lacinulata*** Müll. Arg.
7' Only with marginal soralia, usually in lobe axils **8**

P. lacinulata is considered here as a species of complex and variable morphology. The use of a standard method for defining and measuring lobes (see Material and Methods) resulted in significantly different but more repeatable reported lobe widths, when compared to the traditional arbitrary and undefined method. A full description of the species is given below.

Physcia lacinulata Müll. Arg. emend Scutari
Bull. Soc. R. Bot. Belgique 30: 54 (1891). Figs. 3-6.

Thallus corticolous, suborbicular, up to ca. 3.5 cm diam., more frequently forming irregular patches by confluence, ± loosely attached, when fresh greenish-glaucous, fragile, thin (< 150 μm), upperside smooth, emaculate to minutely maculate, epruinose. Lobes mostly subdichotomous, plane to slightly concave, with entire, erose, crenate, lobulate to phyllidiate and/or sorediate margins, up to 1.5 (-2.6) mm wide, apices broadened, irregularly lobed to parted, frequently concave-ascending, up to (1.5-)2.5-7.4 mm. Phyllidia marginal, less frequently laminal, usually dissected, ascending to replicate; soralia occasionally absent, laminal soralia punctiform to orbicular, solitary to confluent forming small patches, scarce to moderately abundant, marginal soralia punctiform, undulate to linear by confluence, scarce to abundant, developing from phyllidia cicatrices and/or by erosion of phyllidia starting on the underside. Underside whitish, rhizines simple, concolorous. Medulla white, K- to K+ yellow; lower cortex hyaline, variable in structure and thickness, subparaplectenchymatous, composed of leptodermatous to mesodermatous, isodiametric to cylindrical cells. *Apothecia* , spores of the Pachysporaria-type, (14.6-)17.9-22.8(-24.5) x (6.5-)8.1-9.8 µm, sometimes with sporoblastidia (from the type material). *TLC:* atranorin and zeorin.

Specimens examined: **Physcia lacinulata**: ARGENTINA, *Buenos Aires Province, Pdo. Campana,* Ottamendi, reserva, barranca sobre el terraplén, leg. N. Scutari, herb. Scutari n° 231 A. *Martín García Island*, leg. N. Scutari, BAFC 35845a,b, 35894 to 35896, 36745, 36746. *Capital Federal*, Facultad de Agronomía, Jardín Botánico, leg. N. Scutari, herb. Scutari n° 243. *Corrientes Province, Dpto.Capital*, ciudad de Corrientes, Facultad de Ciencias Agrarias, C. Vesconi 44. *Entre Ríos Province, Dpto. Diamante*, Parque Nacional Pre-Delta, BAFC n° 37890, herb. Scutari n° 160, 161 (dupl. in CTES and ND), 218. COSTA RICA, 1890, Pittier n° 5064 (G: lectotype); Pittier n° 5063, 5065 (G: syntypes). **Physcia albata**: AUSTRALIA, Victoria, Mt William near Arnbat, Nov. 1888, leg. Wilson (MEL: lectotype). KENYA, *Central Province,* Mt. Kenya National Park, Naro Moru track, Meteorological Station, Teleki Hut, alt. 3200 m, on *Podocarpus milanjianus,* 1979, R. Moberg 4090 (UPS 11883); Sirimon Track, Sirimon Gate, Camp Site, alt. 2900 m, on *Podocarpus milanjianus,* along the track, R. Moberg 4035 (UPS 11878). *Rift Valley Province*, Aberdare National Park, Wandare's track, along the narrow road from Wandare's Camp Area to Mt Lasatimna, c. 3 km W of Camp Site, alt. 3650 m, on rocks in a steep northern grassy slope, R. Moberg 4330 (UPS 11893). SOUTH AFRICA, *Natal Province,* 2.2 km E of Bulwer, off Hwy R617, indigenous forest on hillside, alt. 1600 m, leg. Hale n° 75202 (UPS 32624). PERÚ, *Junín Province*, Tarma, c. 10 km (road distance) NNE of Palca, alt. 2600 m, matrix: mossy rocks, leg. R. & B. Santesson & R. Moberg P12:05 (UPS 36661). **P. dilatata:** KENYA, *Central Province*, Kirinyaga Distr., Mt. Kenya, near Kamweti Forest Station, on trunk of tree in clearing, alt. 2400 m, T.D.V. Swinscow K50/6 (UPS 6371; dupl. ex BM); Mt. Kenya National Park, Naru Moru track, Meteorological Station, Teleki hut., alt. 3250 m, on trunk of *Hagenia abyssinica*, R. Moberg 4102 (UPS 6360). *Rift Valley Province*, Kajiado par., Ngong Hills, south of the highest part, alt. 2300m, on a shrub, R. Santesson 22743 (UPS 6358); Kajiado Distr., near summit at S end, on branches of shrubs in shade, alt. 2300 m, T.D.V. Swinscow K45/21 (UPS 6369 (dupl. ex BM). TANZANIA, *Kilimanjaro Province*, Mt. Kilimanjaro, W slope, E of Lemosho Glades, alt.

2400 m, on a tree in a dense montane forest, R. Santesson 21044 (UPS 6363). **P. pachyphylla**: ARGENTINA, *Tucumán Province*, Valle de Tafí, wooded valley above Tafí, on a granite boulder, alt. 2080 m, I. M. Lamb 5493 (UPS 37989). COSTA RICA, *San José Province*, city of San José, close to Holland House, on tree-trunk growing as living "fence-posts", alt. 1200 m, L. Tibell 8116 (UPS 36639). ECUADOR, *Loja Province*, 15 km from Macara along road to Cariamanga, disturbed and grazed deciduous forest, on *Bahuinia* sp., exposed, alt. 550 m, B. Stähl, M. Neuendorf, J.-E. Bohlin & R. Lundin 432 (UPS 39498; dupl. ex GB). GUATEMALA, *Retalhuleu Province*, at Retalhuleu, open, dry situation, alt. 500 m, on bark, leg. K. Kalb & G. Plöbst (UPS 45194; dupl. ex Kalb). PERÚ, *Huanuco Province*, valley of Río Huallaga, W of Churubamba, dry rocky slope with scattered trees, on a tree trunk, alt. 1900 m, R. Santesson & R. Moberg P33:25 (UPS 36334). VENEZUELA, *Lara Province*, Serranía de Bobare, entre la quebrada El Vino y Barbacoas, sax., 1700 m, M. López-Figueiras & R. Smith 16546 (UPS 37986).

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LITERATURE

CULBERSON, C. F. (1972). Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *J. Chromatogr.* **72:** 113-125.

CULBERSON, C. F. & KRISTINSSON, H. (1970). A standardized method for the identification of lichen products. *J. Chromatogr.* **46:** 85-93.

ESSLINGER, T. L. (1978). Studies in the lichen family Physciaceae. II. The genus ***Phaeophyscia*** in North America. *Mycotaxon* **7(2):** 283-320.

MOBERG, R. (1990). The lichen genus ***Physcia*** in Central and South America. *Nord. J. Bot.* **10(3):** 319-342.

MÜLLER ARGOVIENSIS, J. (1891). *Lichens*. In: Durand, T. & Pittier, H.: Primitiae flore Costaricensis. *Bull. Soc. R. Bot. Belgique* **30:** 49-97.

SCUTARI, N. C. (1990). Studies on foliose Pyxinaceae (Lecanorales, Ascomycotina) from Argentina, I: new records for South America. *Nova Hedwigia* **50(1-2):** 261-274.

SCUTARI, N. C. (1992a). *Los géneros foliosos y fruticosos de Physciaceae, Candelariaceae y Teloschistaceae (Ascomycotina liquenizados) de la Provincia de Buenos Aires.* Tesis Doctoral, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires (unpublished).

SCUTARI, N. C. (1992b). Estudios sobre Pyxinaceae foliosas (Lecanorales, Ascomycotina) de la Argentina, IV: claves de los géneros y las especies de la Provincia de Buenos Aires. *Bol. Soc. Argent. Bot.* **28:** 169-173.

SCUTARI, N. C. (1992c). Thallus structure in some foliose Physciaceae and a proposal for the standardization of thallus anatomy terminology and methodology. Abstracts, *Second International Lichenological Symposium, IAL 2, PA 16, p. 18, Bästad, Hemmeslöv, Sweden.*

SCUTARI, N. C. (1995a). Los macrolíquenes de Buenos Aires, I: ***Dirinaria*, *Heterodermia*** e ***Hyperphyscia*** (Physciaceae, Ascomycotina). *Darwiniana* **33:** 149-176.

SCUTARI, N. C. (1995b). Los macrolíquenes de Buenos Aires, II: ***Phaeophyscia*, *Physcia*** y ***Pyxine*** (Physciaceae, Ascomycotina). *Darwiniana* **33:** 211-231.

STEARN, W. T. (1996). Botanical Latin, 4th ed. David & Charles.

THOMSON, J. W. (1963). The lichen genus ***Physcia*** in North America. *Beih. Nova Hedwigia* **7:** 1-172.

WHITE, F. J. & JAMES, P. W. (1985). A new guide to microchemical techniques for the identification of lichen substances. *Br. Lichen Soc. Bull. 57 (suppl.).*

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TAXONOMIC NOTES ON THE GENUS SEPTORIA IN KOREA (I)

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ABSTRACT: Thirty species of *Septoria* collected in Korea are listed with descriptions and notes. Of these, *Septoria lycopicola* n. sp. on *Lycopus ramosissimus* var. *japonicus* and *S. menispermicola* n. sp. on *Menispermum dauricum* are described and illustrated in detail. Most species are new records to the fungus flora of Korea.

Keywords: *Septoria*, *S. lycopicola*, *S. menispermicola*, Korea

The genus *Septoria* Sacc. belongs to sympodial Blastopycnidiineae of Coelomycetes, Fungi Imperfecti and contains more than 2,000 described taxa (Sutton, 1980). They are all plant pathogens causing leaf spots and blights in field crops, vegetables, and ornamentals. Though taxonomic studies on species parasitic on various hosts or present in a particular geographical area have been made, this genus is still waiting for world-wide monographic compilation.

In Korea, the species of *Septoria* are poorly known and not yet intensively studied. In some phytopathological papers (cf. The Korean Society of Plant Pathology, 1998), 36 species parasitic on 41 host plants were listed without any mycological comments. Additional 20 host plants were recorded to be associated with unidentified species of *Septoria*. Therefore, mycological studies for the Korean *Septoria* spp. are urgently needed for diagnosis of the diseases and precise identification of the fungus.

The materials listed in the present paper were collected by H. D. Shin in Korea between 1989 to 1998, and the investigation of the specimens was carried out in collaboration by the two authors. The present paper deals with 30 species of *Septoria*, of which two new species, *Septoria lycopicola* and *S.*

menispermicola, are described in detail and illustrated. Most species are new records to the fungus flora of Korea.

All collections, including type specimens, are preserved in SMK (mycological herbarium, Korea University, Korea). Duplicates are housed in SOMF (Institute of Botany, Bulgarian Academy of Sciences, Bulgaria).

(1) *Septoria artemisiae* Pass., Atti Soc. Crittog. Ital. 2: 32 (1879)

Conidiomata pycnidial, scattered, epiphyllous, dark brown, globose, immersed, unilocular, 56-96 ㎛ diam.; ostiole circular, 12-20 ㎛ wide. Conidia holoblastic, filiform, substraight to occasionally slightly curved, subtruncate at basal end, tapered gradually towards the pointed apex, eguttulate, hyaline, 32-56 × 1.6-2.2 ㎛, 2-5-septate, septa indistinct.

Habitat: On living leaves of *Artemisia keiskeana* Miq., *A. lavandulaefolia* DC., and *A. sylvatica* Max. (Asteraceae).

Specimens examined: On *Artemisia keiskeana*, SMK 15198 (24 IX 1998, Pochon); on *A. lavandulaefolia*, SMK 12442 (2 VII 1993, Kangnung), 13369 (8 XI 1994, Kangnung), 13518 (6 VI 1995, Pyongchang); on *A. sylvatica*, SMK 13295 (31 X 1994, Kangnung).

Note: More than 10 different species of *Septoria* have been recorded on *Artemisia* spp., but only *S. artemisiae* was recognized by Lu (1992). Sameva (1991a) distinguished two species on *Artemisia*; *S. artemisiae* Pass. and *S. tabacina* Died. The conidia of the former are longer, narrower (27-48 × 1.7-2.0 ㎛) than those of the latter (20-36 × 2.5-3.0 ㎛). *S. moeszii* Smarods has big conidiomata (120-165 ㎛ diam.) and long conidia (70-135 × 2-3 ㎛). The Korean specimens agree with the phenetic characters of *S. artemisiae* provided by Radulescu *et al.* (1973), Teterevnikova-Babayan (1987), and Vanev *et al.* (1997). This is the first record of this species from Korea.

(2) *Septoria astericola* Ellis & Everh., J. Mycol. 5: 159 (1889)

Septoria tatarica Syd., Ann. Mycol. 12: 163, 1914.

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, dark brown, globose, immersed, unilocular, 48-104 ㎛ diam.; ostiole circular, becoming irregular at maturity or after releasing conidia, 14-21(-32)㎛ wide. Conidia holoblastic, filiform, straight to substraight, subtruncate to obtuse at basal end, obtuse to subacute at distal end, eguttulate, hyaline, 22-44 × 1.2-2.0 ㎛, (1-)2-3-septate, septa indistinct.

Habitat: On living leaves of *Aster scaber* Thunb. and *A. tataricus* L. (Asteraceae).

Specimens examined: On *Aster scaber*, SMK 13849 (27 V 1997, Pyongchang), 13937 (7 VI 1997, Jongsun), 14927 (26 VIII 1998, Kyongju); on *A. tataricus*, SMK 10820 (2 VII 1991, Kangnung), 11753 (3 VII 1992, Kangnung), 11771 (7 VII 1992, Pyongchang), 12397 (19 V 1993, Kangnung), 12844 (5 IV 1993, Samchok), 13852 (27 V 1997, Pyongchang), 13999 (9 VIII 1997, Seoul), 14081 (27 VIII 1997, Pyongchang), 14158 (14 IX 1997, Yangku), 14279 (27 IX 1997, Chunchon), 14369 (4 X 1997, Seoul), 14478 (27 IV 1998, Seoul), 14599 (4 VI 1998, Seoul), 14603 (5 VI 1998, Buyeo), 14645 (7 VI 1998, Seoul).

Note: Shin (1994) recorded this fungus on *Aster tataricus* for the first time in Korea and provided a short description. A specimen on *A. tataricus* (SMK 11994; 20 IX 1992, Hongchon) is somewhat different from the other collections in having much longer conidia (44-80 × 2 ㎛). This specimen is tentatively identified as *S. atro-purpurea* Peck (cf. Saccardo's Syll. Fung. III. p. 549, 1884).

(3) *Septoria betulae* Pass., Comment. Soc. Crittog. Ital. 2: 441 (1867), non (Lib.) Westend. ex Sacc. (1878)

Septoria betulina Pass., Atti Soc. Crittog. Ital. 2: 40, 1879; *Rhabdospora betulina* (Pass.) Kuntze, Rev. Gen. Pl. 3(3): 510, 1898; *Septoria betulicola* Peck, Rep. N.Y. St. Mus. Nat. Hist. 34: 44, 1883, non Lobik, 1928; *Rhabdospora betulicola* (Peck) Kuntze, Rev. Gen. Pl. 3(3): 510, 1898; *Septoria betulicola* Peck var. *marginalis* Peck, Rep. N.Y. St. Mus. Nat. Hist. 34: 44, 1883; *Septoria carpinea* Davis, Trans. Wis. Acad. Sci. Arts Lett. 18: 88, 1915; *Septoria chinensis* Miura, Flora of Manchuria and East Mongolia, III. Cryptogams, Fungi. p. 447, 1928.

Conidiomata pycnidial, scattered, hypophyllous, dark brown to brown, globose, partly immersed, unilocular, 48-80 ㎛ diam.; ostiole subcircular to irregular, 32-64 ㎛ wide. Conidia holoblastic, filiform, substraight to moderately curved, sometimes sharply curved in longer spores, subtruncate at basal end, tapered gradually towards the obtuse apex, eguttulate, hyaline, variable in length, 20-72 × 2.0-2.8 ㎛, 1-5-septate, septa distinct.

Habitat: On living leaves of *Betula platyphylla* var. *japonica* Hara (Betulaceae).

Specimens examined: SMK 13669 (5 X 1996, Chunchon), 15222 (24 IX 1998, Kangnung), 15478 (12 X 1998, Seoul).

Note: Constantinescu (1984) discussed this species in detail and treated the above-mentioned names to be conspecific to *S. betulae*. In Korea, Forestry Research Institute (1991) recorded *S. chinensis* on this host species with a short description (pycnidia 65-85 ㎛, conidia 20-58 × 2.5-2.8 ㎛).

(4) *Septoria callistephi* Gloyer, Phytopathology 11(1): 50 (1921)

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, dark brown, globose, immersed, unilocular, 30-80 ㎛ diam.; ostiole circular to subcircular, 18-32 ㎛ wide. Conidia holoblastic, filiform, substraight to falcate, subtruncate at basal end, narrowly obtuse to pointed at distal end, eguttulate, hyaline, 35-65 × 1.6-2.0 ㎛, (2-)3-5(-6)-septate, septa distinct.

Habitat: On living leaves of *Callistephus chinensis* (L.) Nees (Asteraceae).

Specimens examined: SMK 13700 (5 X 1996, Kangnung), 14022 (25 VIII 1997, Pyongchang), 14865 (21 VIII 1998, Hongchon).

Note: Lee *et al.*(1989) recorded this fungus for the first time in Korea and provided a short description. Our data represent the first detailed examination of the Korean materials, and it is in close agreement with the previous records of this species (Radulescu *et al.*, 1973; Lu, 1992; Vanev *et al.*, 1997).

(5) *Septoria campanulae* (Lév.) Sacc., Syll. Fung. 3: 544, 1884

Ascospora campanulae Lév., Ann. Sci. Nat. Bot., ser. III, 5: 277, 1846; *Septoria* *obscura* Trail, in Scott, Naturalist 10: 73, 1889; *Septoria trachelii* Allesch., in Rabenh., Krypt.-Fl. 6: 747, 1901.

Conidiomata pycnidial, scattered, amphigenous but mostly epiphyllous, dark brown, globose to subangular, immersed, unilocular, 45-99 μm diam.; ostiole circular, 9-18 μm wide. Conidia holoblastic, filiform to rod-shaped, straight or mildly curved, obtuse at basal end, subacute to subobtuse at distal end, eguttulate, hyaline, 20-41 × 1.8-2.5 μm, mostly uniseptate, occasionally aseptate or 2-septate, septa indistinct.

Habitat: On living leaves of *Campanula punctata* Lam. and *C. takesimana* Nakai (Campanulaceae).

Specimens examined: On *Campanula punctata*, SMK 11108 (21 IX 1991, Chunchon), 11743 (28 VI 1992, Pyongchang), 14366 (4 X 1997, Seoul); on *C. takesimana*, SMK 14101 (27 VIII 1997, Pyongchang).

Note: Three species of *Septoria* had been recorded on *Campanula* spp. (cf. Radulescu *et al.*, 1973). The original description of *S. campanulae* was incomplete. Sameva (1991b) discussed this problem and relegated *S. obscura* and *S. trachelii* to synonymy of *S. campanulae*. Shin (1998) first recorded this fungus on *C. punctata* in Korea and provided a short description. The present study adds *C. takesimana* as a new host record to Korea. This species is also new to the East Asia in its distribution.

(6) *Septoria chelidonii* (Lib.) Desm., Ann. Sci. Nat. Bot., ser. II, 17: 110 (1842)

Ascochyta chelidonii Lib., Pl. Crypt. Ard., 57, 1830; *Spilosphaeria chelidonii* (Lib.) Rabenh., Herb. Mycol. 2: 552, 1857.

Conidiomata pycnidial, scattered to confluent, amphigenous, but mostly epiphyllous, dark brown, globose, more or less immersed, unilocular, 62-98 μm diam.; ostiole irregular or ellipsoid, 14-36 μm wide. Conidia holoblastic, filiform, straight to substraight, gently tapered towards each end, obtuse at basal end, narrowly obtuse at distal end, eguttulate, hyaline, 25-54 × 2.0-2.5 μm, 2-3-septate, septa more or less distinct.

Habitat: On living leaves of *Chelidonium majus* var. *asiaticum* (Hara) Ohwi (Papaveraceae).

Specimens examined: SMK 10560 (15 X 1990, Kangnung), 10662 (5 XI 1990, Kangnung), 10834 (4 VII 1991, Kangnung), 11383 (23 X 1991, Kangnung), 11393 (25 X 1991, Kangnung), 11489 (14 XI 1991, Kangnung), 12307 (28 X 1992, Kangnung), 12718 (23 X 1993, Kangnung), 12764 (19 V 1994, Kangnung), 13173 (18 X 1994, Kangnung), 13361 (8 XI 1994, Kangnung), 13460 (1 V 1995, Kangnung), 13488 (18 V 1995, Samchok), 13492 (19 V 1995, Kangnung), 13753 (6 V 1997, Seoul), 13763 (11 V 1997, Namyangju), 14155 (14 IX 1997, Yangku), 14469 (26 IV 1998, Nonsan), 15510 (20 X 1998, Seoul), 15624 (1 XI 1998, Chunchon), 15640 (4 XI 1998, Pochon), 15665 (15 XI 1998, Koyang).

Note: Earlier literature (Jørstad, 1965; Radulescu *et al.*, 1973; Lu, 1992; Vanev *et al.*, 1997) gave relatively short measurements of conidia, in the range of 18-35 μm. Though the Korean specimens show longer conidia (25-54 μm), the other characteristics of taxonomic value for this species are in agreement with the previous records. This is the first record of this species from Korea.

(7) *Septoria chrysanthemella* Sacc., Syll. Fung. 11: 542 (1895)

Septoria chrysanthemi Cavara, Atti Ist. Bot. Pavia, ser. II, p. 266, 1892, non Allesch., 1891; *Septoria chrysanthemi* Rostr., Bot. Tidsskr. 21: 48, 1897; *Septoria rostrupii* Sacc. & Syd., Syll. Fung. 14: 973, 1899; *Septoria varians* Joffrin, Compt. Rend. Hedb. Séances Acad. Sci. 133: 957, 1901; *Septoria chrysanthemi-indici* Bubák & Kabát, Hedwigia 46: 294, 1907.

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, dark brown, globose, more or less immersed, unilocular, 55-95 μm; ostiole circular, 15-35 μm wide. Condia holoblastic, filiform, substraight to straight, subtruncate at basal end, tapered gradually towards the pointed distal end, eguttulate, hyaline, 42-62 × 1.2-1.8 μm, 3-6-septate, septa distinct.

Habitat: On living leaves of *Chrysanthemum morifolium* Ram. and *C. zawadskii* var. *latilobum* Kitamura (Asteraceae).

Specimens examined: On *Chrysanthemum morifolium*, SMK 13804 (25 V 1997, Namyangju), 14906 (25 VIII 1998, Kyongju); on *C. zawadskii* var. *latilobum*, SMK 14099 (27 VIII 1997, Pyongchang).

Note: Punithalingam & Wheeler (1965) discussed several species of *Septoria* recorded on *Chrysanthemum* spp. The Korean materials examined are most close to *S. chrysanthemella*. Park (1958) recorded this species (under *S. chrysanthemi*) on *Chrysanthemum morifolium* for the first time in Korea and provided a short description as follows: Pycnidia globose to subglobose, 75-110 μm diam.; conidia hyaline, filiform, 29-60 × 2.0-2.8 μm. The present data add *C. zawadskii* var. *latilobum* as a new host record to Korea.

(8) *Septoria codonopsidis* Ziling, Acta Inst. Bot. Akad. Sci. USSR, ser. II, 3: 692 (1936)

Conidiomata pycnidial, scattered, amphigenous, dark brown, globose, immersed, unilocular, 40-72 μm diam.; ostiole irregular to radiated, 18-36 μm wide. Conidia holoblastic, filiform, substraight to falcate, gently tapered towards each end, subobtuse at basal end, subacute at distal end, eguttulate, hyaline, 18-38 × 1.4-2.0 μm, (1-)2-3-septate, septa indistinct.

Habitat: On living leaves of *Codonopsis lanceolata* (Sieb. & Zucc.) Trautv. (Campanulaceae).

Specimens examined: SMK 12554 (20 VIII 1993, Suwon), 12993 (13 IX 1994, Chonju), 14026 (25 VIII 1997, Pyongchang), 14824 (19 VIII 1998, Chunchon).

Note: This fungus was recorded from China (Lu, 1992) and Far East of USSR (Teterevnikova-Babayan, 1987). Shin (1998) added Korea for its geographical distribution and made detailed description of the species.

(9) *Septoria convolvuli* (Lib.) Desm., Ann. Sci. Nat. Bot., ser. II, 17: 108 (1842)

Ascochyta convolvuli Lib., Pl. Crypt. Ard., 56, 1830; *Septoria flagellaris* Ellis & Everh., Bull. Torrey Bot. Club 10: 97, 1883; *Septoria septulata* Beach, Amer. J. Bot. 6: 19, 1919.

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, dark brown to brown, globose, immersed, unilocular, 63-117 ㎛ diam.; ostiole subcircular to angular, 16-45 ㎛ wide. Conidia holoblastic, filiform, substraight to mildly curved, subtruncate at basal end, subobtuse at distal end, eguttulate, hyaline, 28-66 × 2.0-2.4 ㎛, (2-)3-5(-7)-septate, but mostly 3-septate, septa indistinct.

Habitat: On living leaves of *Calystegia hederacea* Wall. and *C. soldanella* Roem. & Schult. (Convolvulaceae).

Specimens examined: On *Calystegia hederacea*, SMK 13349 (6 XI 1994, Kangnung); on *C. soldanella*, SMK 10355 (29 VII 1990, Kangnung), 10924 (26 VII 1991, Kangnung), 11775 (12 VII 1992, Kangnung).

Note: More than 10 different species of *Septoria* have been recorded on *Calystegia* and *Convolvulus* spp. Of these, *S. calystegiae* Westend. was transferred to the genus *Stagonospora* (Grove, 1935). The whole complex of *Septoria* species on Convolvulaceae needs revision. Nevertheless, the Korean collections agree well with *S. convolvuli*. Shin (1998) first recorded this species on *C. soldanella* in Korea and gave a short description. *Calystegia hederacea* is a new host record to Korea.

(10) *Septoria erigerontis* Peck, Ann. Rep. N.Y. State Mus. Nat. Hist. 24: 67 (1872)

Septoria erigerontis Berk. & Curtis, North. Am. Fungi, p. 437, 1874 (homonym); *Septoria erigeronata* Thüm., Bull. Soc. Imp. Nat. Moscou 56: 132, 1881; *Septoria erigerontea* Sacc., Syll. Fung. 3: 547, 1884; *Septoria chanousii* Ferraris, Malphigina 27, 1902; *Septoria erigerontis* Hollós, Math. Termész. Közlém. Magy. Tudom. Akad. 35: 57, 1926 (homonym).

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, brown to dark brown, globose, immersed, unilocular, 80-144 ㎛ diam.; ostiole circular, 11-22 ㎛ wide. Conidia holoblastic, filiform, straight to substraight, subtruncate at basal end, gently tapered towards the narrowly obtuse distal end, eguttulate, hyaline, 32-65 × 1.8-2.4 ㎛, 1-3(-5)-septate, septa indistinct.

Habitat: On living leaves of *Erigeron annuus* (L.) Pers. and *E. canadensis* L. (Asteraceae).

Specimens examined: On *Erigeron annuus*, SMK 10239 (3 X 1989, Kangnung), 10388 (7 IX 1990, Kangnung), 10900 (18 VII 1991, Kangnung), 11237 (5 X 1991, Kangnung), 11415 (30 X 1991, Kangnung), 11513 (16 XI 1991, Kangnung), 12014 (22 IX 1992, Kangnung), 12030 (1 X 1992, Kangnung), 12182 (14 X 1992, Kangnung), 12217 (20 X 1992, Kangnung), 12298 (27 X 1992, Kangnung), 12318 (28 X 1992, Kangnung), 12409 (24 VI 1993, Kangnung), 12688 (10 X 1993, Kangnung), 13234 (27 X 1994, Kangnung), 13290 (31 X 1994, Kangnung), 13440 (24 XI 1994, Kangnung), 13443 (27 XI 1994, Kangnung), 13454 (7 XII 1994, Kangnung), 13461 (1 V 1995, Kangnung), 13505 (23 V 1995, Kangnung), 13537 (15 VI 1995, Kangnung), 13653 (10 IX 1996, Kangnung), 13748 (2 V 1997, Seoul), 13755 (6 V 1997, Seoul), 13765 (11 V 1997, Namyangju), 13928 (4 VI 1997, Suwon), 14008 (25 VIII 1997, Pyongchang), 14379 (4 X 1997, Seoul), 14484 (27 IV 1994, Seoul), 14552 (29 V 1998, Seoul), 15031 (4 IX 1998, Seoul), 15185 (24 IX 1998, Pochon), 15315 (4 X 1998, Yonchon), 15615 (28 X 1998, Namyangju), 15639 (4 XI 1998, Pochon), 15662 (15 XI 1998, Yongin); on *E. canadensis*, SMK 15316 (4 X 1998, Yonchon).

Note: Park (1967) recorded this fungus on *Erigeron annuus* and *E. canadensis* for the first time in Korea and provided a short description as follows: Pycnidia globose, blackish brown, 60-125 μm; conidia filiform, 0-4-septate, hyaline, 18-51 × 1.2-2.0 μm. The Korean collections are in general in accordance with the previous records of this species (Jørstad, 1965; Radulescu *et al.*, 1973; Lu, 1992).

(11) ***Septoria gei*** **Roberge & Desm.**, Ann. Sci. Nat. Bot., ser. II, 19: 342 (1843)

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, dark brown, globose, immersed, unilocular, 48-64 μm diam.; ostiole subcircular to irregular, (24-)32-48 μm wide. Conidia holoblastic, filiform, falcate to moderately curved, subtruncate at basal end, narrowly obtuse at distal end, eguttulate, hyaline, 48-92 × 1.8-2.2 μm, 3-9-septate, septa distinct.

Habitat: On living leaves of *Geum japonicum* Thunb. (Rosaceae).

Specimens examined: SMK 13004 (13 IX 1994, Chonju), 13697 (2 X 1996, Chunchon), 13814 (25 V 1997, Chunchon), 14456 (23 X 1997, Suwon), 14817 (19 VIII 1998, Chunchon), 15362 (5 X 1998, Chunchon).

Note: This species is the only one recorded on *Geum* spp. The conidia seem to be variable: 30-65 × 1-1.5 μm (Constantinescu, 1962); 20-75 × 1-1.5(-2)μm, up to 4-septate (Jørstad, 1965); 20-53 × 1.5-2.2 μm, 1-4-septate (Radulescu *et al.*, 1973); 45-80 × 1-2 μm, 3-9-septate (Lu, 1992); 24-76 × 1.2-2 μm, 1-4-septate (Vanev *et al.*, 1997). As discussed by Lu (1992), the conidia in the Oriental specimens seem to be longer and have more septa than those of the Western collections. However, the other morphological characteristics of taxonomic value are in agreement among these authors. Shin (1998) recorded this fungus for the first time in Korea, providing a short description and phytopathological notes.

(12) ***Septoria lychnidis*** **Desm.**, Ann. Sci. Nat. Bot., ser. III, 11: 347 (1849)

Septoria melandrii Pass., Atti Soc. Crittog. Ital. 2: 22, 1879; *Septoria silenicola* Ellis & G.W. Martin, Amer. Naturalist, p. 1001, 1882; *Septoria lychnidis* var. *pusilla* Trail, Scott. Naturalist 9: 89, 1887; *Septoria pusilla* (Trail) Bubák, Növényt. Közlem. 6: 49, 1907; *Septoria lychnidicola* Brunaud, Ann. Soc. Sci. Nat. Charente-inférieure Acad. Rochelle, 1890, p. 77, 1889; *Septoria melandrii-albi* Bäumler, Verh. Vereins Natur., Heikl. Presburg 14: 47, 1903.

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, dark brown, globose, immersed, unilocular, 72-126 μm diam.; ostiole circular to angular, 10-28 μm wide, sometimes up to 64 μm wide possibly due to mechanical destruction of conidiomatal walls. Conidia holoblastic, mildly curved to falcate, tapered gradually towards obtuse ends, eguttulate, hyaline, 34-72×2.2-2.8 μm, 1-3(-4)-septate, septa distinct.

Habitat: On living leaves of *Lychnis cognata* Max. (Caryophyllaceae).

Specimens examined: SMK 10336 (21 VII 1990, Pyongchang), 10916 (20 VII 1991, Pyongchang), 12459 (15 VII 1993, Pyongchang), 12805 (1 VI 1994, Kangnung), 13546 (16 VI 1995, Kangnung).

Note: The Korean materials agree well with the previous records of this species (Grove, 1935; Jørstad, 1965; Radulescu *et al*., 1973; Vanev *et al*., 1997). Shin (1995) recorded this species for the first time in Korea and provided a short description, and phytopathological notes.

(13) ***Septoria lycopersici*** **Speg.**, Anales Soc. Ci. Argent. 12: 115 (1882)

Conidiomata pycnidial, scattered to confluent, amphigenous, mostly epiphyllous, dark brown, globose, more or less immersed, unilocular or occasionally bilocular, 96-160 μm diam.; ostiole circular to subangular, up to 60 μm wide. Conidia holoblastic, filiform, mildly curved to sigmoid, subtruncate at basal end, tapered gradually towards the obtuse distal end, subhyaline, guttulate or eguttulate, 50-148×2.0-2.8 μm, 5-10-septate, septa distinct.

Habitat: On living leaves of *Lycopersicon esculentum* Mill. (Solanaceae).

Specimens examined: SMK 13273 (29 X 1994, Chunchon), 14113 (4 IX 1997, Kwachon), 14184 (15 IX 1997, Yangku), 14769 (13 VIII 1998, Yangku), 15432 (9 X 1998, Chunchon).

Note: Nakata & Takimoto (1928) recorded this species for the first time in Korea and described the conidia as septate, 70-110×3.3 μm. Recently Cho *et al*. (1997) recorded this fungus as follows: Pycnidia dark brown, subglobose, 190-320×90-210 μm; conidia hyaline, filiform, 2-9-septate, 32-103 ×2-3 μm.

(14) ***Septoria lycopicola*** **H.D. Shin & Sameva sp. nov.** **Fig. 1**

Conidiomata pycnidialia, plerumque solitaria ad macula, epiphylla, atrobrunnea, globosa, immersa, unilocularia, 56-96(-136)μm diam.; ostiolum irregularum vel angularum, 18-44 μm latum. Cellulae conidiogenae sympodulae, lageniformes vel ampulliformes, hyalinae, 6-15×2.5-4.5 μm. Conidia holoblastica, filiformia, curvata, interdum sigmoidea vel subrecta, basi subtruncata vel obtusa, in apicem subobtusum versus gradatim deminuta, eguttulata, hyalina, 35-118×1.6-2.5 μm, 3-11-septata, septa distincta.

Conidiomata pycnidial, only one to three per small leaf lesion, epiphyllous, dark brown, globose, immersed, unilocular, 56-96(-136)μm diam.; ostiole irregular to angular, 24-44 μm wide. Conidiogenous cells sympodial, lageniform to ampulliform, hyaline, 6-15×2.5-4.5 μm. Conidia holoblastic, filiform, slightly to moderately curved, sometimes sigmoid or substraight, subtruncate to obtuse at basal end, tapered towards the subobtuse distal end, eguttulate, hyaline, 35-118×1.6-2.5 μm, 3-11-septate, septa distinct.

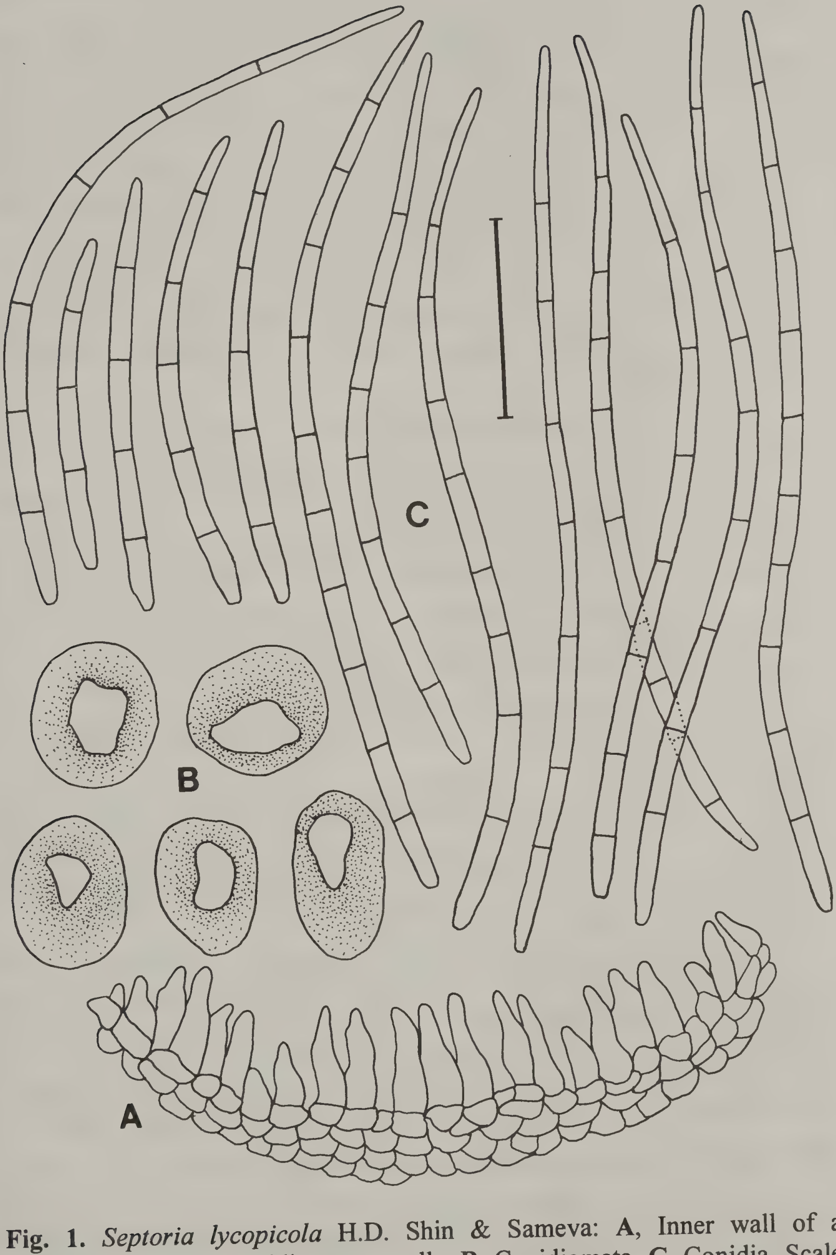

Fig. 1. *Septoria lycopicola* H.D. Shin & Sameva: **A**, Inner wall of a conidioma showing conidiogenous cells. **B**, Conidiomata. **C**, Conidia. Scale bar = 100 µm for B and 20 µm for A & C. H.D. Shin del.

Holotypus: In foliis vivis *Lycopi ramosissimi* var. *japonici* Kitamura (Lamiaceae), Kangnung, Korea, Shin, 7 VII 1992 (SMK 11767).

Additional specimens examined: SMK 12429; SOMF 22245 (26 VI 1993, Pyongchang), 13551 (16 VI 1995, Kangnung).

Note: Only one species of *Septoria* has been described on *Lycopus* spp., namely *S. lycopi* Pass. Our species differs from *S. lycopi* having shorter conidia (50×2 μm in Saccardo's Syll. Fung. III, p. 540, 1884; 35-45×2.5 μm in Radulescu *et al.*, 1973). *Lycopus* spp. have wrongly been indicated as hosts of *S. anchusae* Syd. instead of *Lycopsis* spp. (Boraginaceae) in Vanev *et al.* (1997). There is no *Septoria* species having such long conidia on *Lycopus* and related genera of Lamiaceae. Therefore, this fungus is considered as a new, undescribed species. Leaf lesions are usually small, 2-5 mm diam., angular, vein-limited. It is of interest that only one or at most 3 conidiomata are formed per lesion.

(15) *Septoria lysimachiae* (Lib.) Westend., Bull. Acad. Roy. Sci. Belgique, ser. III, 19: 120 (1852)

Ascochyta lysimachiae Lib., Pl. Crypt. Ard. 252, 1834; *Septoria barystachyiae* Miura, Fl. Manch. East Mong. III. p. 460, 1928.

Conidiomata pycnidial, scattered, amphigenous, sometimes only epiphyllous, brown, globose, immersed, unilocular, relatively small, 35-71 μm diam.; ostiole angular to subcircular, 22-48 μm wide. Conidia holoblastic, filiform, moderately to sharply curved, sometimes sigmoid, obtuse to subtruncate at basal end, narrowly obtuse at distal end, eguttulate, hyaline, 38-70 ×1.6-2.5 μm, 3-7-septate, septa indistinct.

Habitat: On living leaves of *Lysimachia barystachys* Bunge and *L. clethroides* Duby (Primulaceae).

Specimens examined: On *Lysimachia barystachys*, SMK 15359 (5 X 1998, Chunchon); on *L. clethroides*, SMK 10997 (6 IX 1991, Kangnung), 11059 (15 IX 1991, Kangnung), 11387 (23 X 1991, Kangnung), 11993 (20 IX 1992, Hongchon), 12620 (10 IX 1993, Pyongchang), 12660 (30 IX 1993, Chunchon), 12683 (9 X 1993, Kangnung), 14090 (27 VIII 1997, Pyongchang), 14129 (4 IX 1997, Seoul), 14179 (15 IX 1997, Chunchon), 15009 (4 IX 1998, Seoul).

Note: This fungus is the only species recorded on *Lysimachia* spp. The morphological characteristics of taxonomic value for this species, as presented by various authors (Grove, 1935; Jørstad, 1965; Radulescu *et al*, 1973; Lu, 1992; Vanev *et al.*, 1997), do not vary much. Only the conidial measurements seem to be variable. The Korean materials have longer conidia than those of the previous records. This is the first record of this species from Korea.

(16) *Septoria menispermicola* H.D. Shin & Sameva sp. nov. **Fig. 2**

Conidiomata pycnidialia, discreta, amphigena, atrobrunnea, globosa, immersa, unilocularia, 40-72 μm diam.; ostiolum irregularum vel angularum, 25-50 μm latum. Cellulae conidiogenae sympodulae, lageniformes vel ampulliformes, hyalinae, 5-16×2.5-6.5 μm. Conidia holoblastica, filiformia, leniter

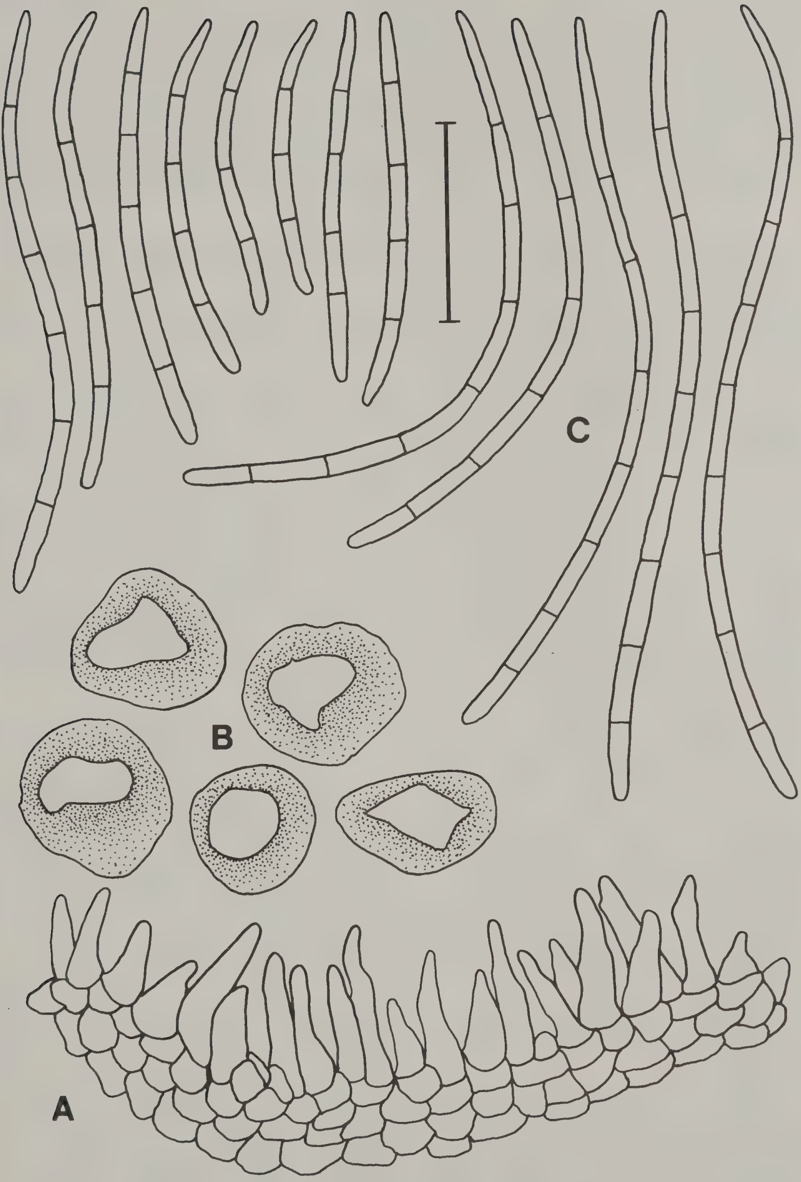

Fig. 2. *Septoria menispermicola* H.D. Shin & Sameva: **A**, Inner wall of a conidioma showing conidiogenous cells. **B**, Conidiomata. **C**, Conidia. Scale bar = 100 ㎛ for B and 20 ㎛ for A & C. H.D. Shin del.

curvata vel sigmoidea, basi subtruncata, ad apicem subacuta, eguttulata, hyalina, 32-110 × 1.6-2.5 μm, 3-8-septata, septa fere distincta.

Conidiomata pycnidial, scattered, amphigenous, dark brown, globose, immersed, unilocular, 40-72 μm diam.; ostiole irregular to angular, 25-50 μm wide. Conidiogenous cells sympodial, lageniform to ampulliform, hyaline, 5-16 × 2.5-6.5 μm. Conidia holoblastic, filiform, mildly curved to sigmoid, subtruncate at basal end, subacute at distal end, eguttulate, hyaline, 32-110 × 1.6-2.5 μm, 3-8-septate, septa more or less distinct.

Holotypus: In foliis vivis *Menispermi daurici* DC. (Menispermaceae), Kangnung, Korea, Shin, 31 VIII 1991 (SMK 10976).

Additional specimens examined: SMK 12963; SOMF 22246 (3 IX 1994, Pyongchang), 13329 (1 XI 1994, Samchok), 14630 (7 VI 1998, Chunchon), 14714 (7 VII 1998, Kangnung).

Note: Two species of *Septoria* have been described on *Menispermum* spp.: *S. abortiva* (Ellis & Kellerm.) Tehon & E.Y. Daniels (1927) having small (17-23 × 1-1.5 μm), 0-4-septate conidia, and *S. menispermi* Thüm. with very large conidiomata (60-150 μm diam. in Lu, 1992) and comparatively small conidia (mostly uniseptate, 40 × 1.5 μm in Saccardo's Syll. Fung. III, p. 555, 1884; 3-4-septate, 22-67 × 1-2 μm in Lu, 1992). These two species are clearly different from our collection. *Septoria menispermicola* is characterized by its long, sigmoid, multiseptate conidia. It markedly differs from other *Septoria* species from *Menispermum* and related genera. Consequently, this fungus is considered as a new, undescribed species.

(17) *Septoria noli-tangeris* W.R. Gerard, Bull. Torrey Bot. Club, p. 64 (1873-1874)

Septoria noli-tangere Thüm., Fl. Kirgh., in N. Giorn. Bot. Ital. 12: 199, 1880.

Conidiomata pycnidial, scattered, epiphyllous, dark brown, globose, immersed, unilocular, 48-72 μm diam.; ostiole circular, 16-24 μm wide. Conidia holoblastic, filiform, substraight to mildly curved, subtruncate to obtuse at basal end, gently tapered towards the subacute distal end, hyaline, guttulate 14-36 × 1.4-2.0 μm, uniseptate or 3-septate, septa indistinct.

Habitat: On living leaves of *Impatiens noli-tangere* L. and *I. textori* Miq. (Balsaminaceae).

Specimens examined: On *Impatiens noli-tangere*, SMK 14160 (14 IX 1997, Yangku); on *I. textori*, SMK 13062 (25 IX 1994, Kangnung), 13588 (23 VI 1995, Kangnung).

Note: The conidia of this species were originally described as 15-30 × 2 μm, and similar dimensions were given by Radulescu *et al.* (1973). The conidia of this species were described as uniseptate, whereas those of *S. balsaminae* Pass. are 3-septate. The conidia in the Korean specimens are chiefly uniseptate but occasionally 3-septate. Further studies are necessary to find out whether these two fungi are conspecific or not. This is the first record of *S. noli-tangeris* from Korea.

(18) *Septoria oenanthes* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia, p. 367. (1894)

Conidiomata pycnidial, scattered, epiphyllous, occasionally also hypophyllous, sometimes also on petioles and stems, dark brown, globose, immersed, unilocular, 63-117 ㎛ diam.; ostiole circular, 8-14 ㎛ wide. Conidia holoblastic, filiform, substraight to mildly curved, obtuse to subtruncate at basal end, tapered gradually towards the narrowly obtuse distal end, subhyaline due to oil drops, guttulate, 29-61 × 1.8-2.7 ㎛, (2-)3-7-septate, septa distinct.

Habitat: On living leaves of *Oenanthe javanica* (Bl.) DC. (Apiaceae).

Specimens examined: SMK 11459 (6 XI 1991, Kangnung), 11539 (17 XI 1991, Kangnung).

Note: Cho *et al.* (1997) recorded a *Septoria* sp. on this host species having the following characters: Pycnidia blackish brown, globose to subglobose, 120-250 ㎛ diam.; conidia filiform, 3-4-septate, hyaline, 40-80 × 2-3 ㎛. Though the description is rather brief, the fungus seems to belong to *S. oenanthes*. This species was firstly recorded in Korea by Shin (1998). According to the original description (cf. Saccardo's Syll. Fung. XI, p. 542, 1895), the conidia of this species are only 20-35 ㎛ long. In the Korean materials, they are much longer, and multiseptate.

(19) *Septoria oenotherae* Westend., Bull. Acad. Roy. Sci. Belgique, ser. III, 12: 7 (1845)

Conidiomata pycnidial, scattered, amphigenous, dark brown to brown, globose, immersed, unilocular, 80-112 ㎛ diam.; ostiole subcircular, 24-32 ㎛ wide. Conidia holoblastic, filiform, straight to substraight, obtuse at basal end, narrowly obtuse to subacute at distal end, hyaline, 36-68 × 1.6-2.2 ㎛, 3-6-septate, septa distinct.

Habitat: On living leaves of *Oenothera odorata* Jacq. (Onagraceae).

Specimens examined: SMK 11979 (19 IX 1992, Hongchon), 12511 (9 VIII 1993, Kangnung), 12655 (30 IX 1993, Chunchon), 12969 (5 IX 1994, Chunchon), 13929 (4 VI 1997, Suwon), 14016 (25 VIII 1997, Pyongchang).

Note: This species was previously recorded from Korea by Shin (1998). The Korean materials agree well with the previous records (Grove, 1935; Radulescu *et al.*, 1973; Lu, 1992)

(20) *Septoria patriniae* Novos., Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Akad. Nauk SSSR 4(10-12): 38 (1938).

Conidiomata pycnidial, scattered, amphigenous, brown, globose, immersed, unilocular, relatively small, 36-54(-63)㎛ diam.; ostiole circular to irregular, relatively large, 12-42 ㎛ wide. Conidia holoblastic, filiform, straight to substraight, obtuse at basal end, subacute at distal end, eguttulate, hyaline, 14-38(-47) × 1.2-1.6 ㎛, uniseptate, occasionally aseptate (possibly immature), septa indistinct.

Habitat: On living leaves of *Patrinia scabiosaefolia* Fisch. and *P. villosa* (Thunb.) Juss. (Valerianaceae).

Specimens examined: On *Patrinia scabiosaefolia*, SMK 11095 (21 IX 1991, Chunchon), 14013 (25 VIII 1997, Pyongchang), 14300 (27 IX 1997, Chunchon), 14814 (19 VIII 1998, Chunchon); on *P. villosa*, SMK 10959 (28 VIII 1991, Kangnung), 11000 (6 IX 1991, Kangnung), 14715 (7 VII 1998, Kangnung).

Note: This is the first record of this species from Korea. Though in the Korean specimens the conidiomata are smaller and the conidia longer than indicated in the literature (pycnidia 50-150 μm diam., conidia 14-25 × 1 μm in Teterevnikova-Babayan, 1987), the other characteristics of taxonomic value for the species are in agreement with the previous records.

(21) ***Septoria perillae*** **I. Miyake**, Bot. Mag. Tokyo 28: 52 (1914)

Septoria kishitai Fukushi, J. Plant Prot. (Japan) 12: 573, 1925.

Conidiomata pycnidial, scattered to confluent, hypophyllous, dark brown, globose, immersed, unilocular, 48-88 μm diam.; ostiole circular, 16-28 μm wide. Conidia holoblastic, filiform, substraight to falcate, subtruncate at basal end, gently tapered towards the subacute distal end, eguttulate, hyaline, 24-48 × 1.4-2.2 μm, (2-)3-4(-5)-septate, septa more or less distinct.

Habitat: On living leaves of *Perilla frutescens* var. *acuta* Kudo and *P. frutescens* var. *japonica* Hara (Lamiaceae).

Specimens examined: On *Perilla frutescens* var. *acuta*, SMK 12596 (3 IX 1993, Suwon); on *P. frutescens* var. *japonica*, SMK 12447 (4 VII 1993, Kangnung), 13012 (14 IX 1994, Taejon), 13052 (22 IX 1994, Kangnung), 13625 (4 VII 1995, Kangnung), 13978 (20 VI 1997, Seoul), 14243 (27 IX 1997, Chunchon), 14281 (27 IX 1997, Chunchon), 14610 (7 VI 1998, Seoul), 14710 (3 VII 1998, Yangku), 14770 (13 VIII 1998, Yangku), 15091 (11 IX 1998, Suwon).

Note: According to the original description, the conidia are 1-3-septate and 24-32(-40) × 2 μm. Lu (1992) gave larger dimensions of conidia (25-50 × 1-2 μm) and described them as 1-5-septate, which are in close agreement with characteristics of the Korean collections. Nakata & Takimoto (1928) recorded this species on *Perilla frutescens* var. *acuta* for the first time in Korea (conidia 1-3-septate, 20-35 × 1.7-2.1 μm). *P. frutescens* var. *japonica* is a new host record to Korea.

(22) ***Septoria phlogis*** **Sacc. & Speg.**, in Sacc., Michelia 1: 184 (1878)

Septoria divaricatae Ellis & Everh., J. Mycol. 5: 151, 1889; *Septoria drummondii* Ellis & Everh., J. Mycol. 7: 133, 1892; *Septoria phlogina* Bondartsev, Materialy Mikol. Obsled. Rossii 5(2): 7, 1921.

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, dark brown to brown, globose, immersed, unilocular, 72-112 μm diam.; ostiole circular, 15-24 μm wide. Conidia holoblastic, filiform, straight to mildly curved, subtruncate at basal end, subacute at distal end, eguttulate, hyaline, 42-74 × 1.4-2.0 μm, 3-5(-6)-septate, septa more or less distinct.

Habitat: On living leaves of *Phlox drummondii* Hooker (Polemoniaceae).

Specimens examined: SMK 13339 (5 XI 1994, Suwon), 13811 (25 V 1997, Namyangju).

Note: The above-mentioned synonymy follows Jørstad (1965). This is the first record of this species from Korea.

(23) ***Septoria picridis*** **T. Ishiyoina**, Trans. Sapporo Nat. Hist. Soc. 13(3): 219 (1933-1934)

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, brown, globose, immersed, unilocular, 64-96 ㎛ diam.; ostiole circular, 8-12 ㎛ wide. Conidia holoblastic, filiform, substraight to mildly curved, subtruncate at basal end, gently tapered at the distal portion, subacute at distal end, hyaline, guttulate, 36-92 × 2.0-2.4 ㎛, 3-5-septate, septa distinct.

Habitat: On living leaves of *Picris hieracioides* var. *glabrescens* Ohwi (Asteraceae).

Specimens examined: SMK 12041 (1 X 1992, Pyongchang).

Note: The Korean collection is in general in accordance with the description by Teterevnikova-Babayan (1987) except for the conidia that were indicated as aseptate by her. In our collection the conidia are, however, clearly 3-5-septate. Her description of aseptate conidia may be due to either the examination of very young specimen, or the failure to notice them. This is the first record of this species from Korea.

(24) ***Septoria plectranthi*** **Ziling**, Acta Inst. Bot. Acad. Sci. USSR, ser. II, 3: 694 (1935)

Septoria plectranthi Bunkina, J. Bot. Acad. Sci. Ukr. 20(6): 96, 1963 (homonym); *Septoria plectranthicola* Melnik, Nov. Sist. niz. Rast. p. 155, 1965.

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, dark brown, globose, immersed, unilocular, 40-64 ㎛ diam.; ostiole circular to irregular, 13-36 ㎛ wide. Conidia holoblastic, filiform, substraight to mildly curved, subtruncate at basal end, narrowly subobtuse to subacute at distal end, eguttulate, hyaline, 22-52 × 1.6-2.2 ㎛, 1-3(-4)-septate, septa more or less indistinct.

Habitat: On living leaves of *Plectranthus inflexus* Vahl (Lamiaceae).

Specimens examined: SMK 11676 (16 VI 1992, Kangnung), 13096 (28 IX 1994, Kangnung), 13843 (26 V 1997, Samchok), 14681 (28 VI 1998, Dongduchon).

Note: Lu (1992) discussed this species and treated the above-mentioned species as conspecific. He recorded the conidia of this species as 3-7-septate, but the Korean materials show 1-3(-4) septa (3-4-septate in Bunkina, 1963). The other characteristics of taxonomic value match well each other. Shin (1995) recorded this species for the first time in Korea, providing a short description and phytopathological notes.

(25) ***Septoria rohlenae*** **Bubák**, Bull. Herb. Boissier, ser. II, 6: 479 (1908)

Septoria scrophulariae Westend., Bull. Acad. Roy. Sci. Belgique, ser. II, 7: 93, 1854 (nomen nudum); *Septoria scrophulariae* Peck, Ann. Rep. New York State Mus. 28: 57, 1876 (homonym).

Conidiomata pycnidial, scattered, epiphyllous, rarely hypophyllous, dark brown, globose, immersed, unilocular, 72-117 ㎛ diam.; ostiole circular, 18-27 ㎛ wide. Conidia holoblastic, filiform, mildly curved to falcate, obconically truncate to subtruncate at basal end, gently tapered towards the narrowly obtuse distal end, guttulate, hyaline to subhyaline, 18-47 × 1.8-2.5 ㎛, 2-6-septate, septa distinct.

Habitat: On living leaves of *Scrophularia buergeriana* Miq. (Scrophulariaceae).

Specimens examined: SMK 11026 (21 IX 1991, Chunchon), 12994 (13 IX 1994, Chonju), 13262 (29 X 1994, Chunchon), 14813 (19 VIII 1998, Chunchon).

Note: The characters shown by the Korean materials agree well with the previous records of this species (Radulescu *et al.*, 1973; Vanev *et al.*, 1997). This is the first record of this species from Korea.

(26) *Septoria rubi* Westend., Herb. Crypt. Belg. p. 938 (1854)

Rabdospora rubi Ellis, J. Mycol. p. 90, 1887; *Septoria rubi* Westend. var. *saxatilis* All., Ber. Bayer Bot. Ges. 2(B): 16, 1891; *Septoria rubi* Westend. var. *asiatica* Bubák, Ann. Naturhist. Hofmus. Wien. 23: 105, 1909; *Septoria campoi* Speg., Bol. Acad. Nac. Cienc. Cordoba 25: 108, 1921.

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, brown, globose, immersed, unilocular, 45-80 ㎛ diam.; ostiole circular to subangular, 24-36 ㎛ wide. Conidia holoblastic, filiform, substraight to falcate, subtruncate at basal end, subacute to narrowly subobtuse at distal end, eguttulate, hyaline, 32-66 × 1.6-2.4 ㎛, 1-3(-4)-septate, septa indistinct.

Habitat: On living leaves of *Rubus crataegifolius* Bunge (Rosaceae).

Specimens examined: SMK 10693 (13 XI 1990, Kangnung), 13553 (16 VI 1995, Pyongchang).

Note: This species was discussed by Jørstad (1965) in detail. Shin (1998) recorded this species first in Korea with a short description, and phytopathological notes.

(27) *Septoria siegesbeckiae* Siemaszko, Mat. k mik. fl. Kavk. kr., 2 (1922); Acta Soc. Bot. Polon. I: 8 (1923)

Conidiomata pycnidial, scattered, amphigenous, brown, globose, immersed, unilocular, 56-88 ㎛ diam.; ostiole circular, 14-24 ㎛ wide. Conidia holoblastic, filiform, straight to mildly curved, subtruncate at basal end, narrowly obtuse at distal end, eguttulate, hyaline, 28-56 × 1.4-2.0 ㎛, 2-3-septate, septa more or less distinct.

Habitat: On living leaves of *Siegesbeckia glabrescens* Makino and *S. pubescens* Makino (Asteraceae).

Specimens examined: On *Siegesbeckia glabrescens*, SMK 14887 (21 VIII 1998, Hongchon); on *S. pubescens*, SMK 13301 (31 X 1994, Kangnung), 13715 (9 X 1996, Kangnung), 14289 (27 IX 1997, Chunchon).

Note: This species was recorded from Caucasus, USSR (Teterevnikova-Babayan, 1987). The Korean materials slightly differ by having amphigenous conidiomata and longer conidia. This is the first record of the species from Korea.

(28) *Septoria sonchi* Sacc., Michelia 1: 183 (1878)

Conidiomata pycnidial, scattered, amphigenous, but mostly epiphyllous, dark brown, globose, more or less immersed, unilocular, 72-128 μm diam.; ostiole circular, small, 6-16 μm wide. Conidia holoblastic, filiform, straight to substraight, subobtuse at each end, sometimes subacute at distal end, subhyaline, 16-32 × 1.2-2.0 μm, uniseptate, occasionally aseptate or 2-septate, septa indistinct.

Habitat: On living leaves of *Sonchus asper* (L.) Hill and *S. oleraceus* L. (Asteraceae).

Specimens examined: On *Sonchus asper*, SMK 15538 (23 X 1998, Koyang), 15663 (15 XI 1998, Koyang); on *S. oleraceus*, SMK 12527 (16 VIII 1993, Kangnung), 14724 (30 VII 1998, Seoul), 14793 (18 VIII 1998, Seoul).

Note: Four species of *Septoria* have been described on *Sonchus* spp., but their delimitation is still unclear. *S. sonchina* Thüm. was treated as synonym of *S. sonchifolia* Cooke (Jørstad, 1965; Radulescu *et al.*, 1973; Vanev *et al.*, 1997). *S. sonchi-arvensis* Dearn. & Bisby is not well documented. Jørstad (1965) considered that *S. sonchi* is different from *S. sonchifolia* with respect to pycnidia and the symptoms produced. Sameva (1987) also compared these two species. In contrast, Lu (1992) regarded these four species are conspecific. Until the taxonomic revision of *Sonchus-Septoria* complex is made, we tentatively place our fungus in the oldest name, *S. sonchi*. This is the first record of this species from Korea.

(29) *Septoria taraxaci* Hollós, Ann. Mus. Nat. Hung. 5: 462 (1907)

Septoria miuraei Trotter, Ann. Mycol. 11: 116, 1913; *Septoria taraxacicola* Miura, Ann. Mycol. 11: 116. 1913.

Conidiomata pycnidial, amphigenous, but mostly hypophyllous, dark brown, globose, more or less immersed, unilocular, 36-80 μm diam.; ostiole circular, 16-24 μm wide. Conidia holoblastic, filiform to rod-shaped, substraight to moderately curved, subobtuse at basal end, narrowly obtuse to subacute at distal end, hyaline, 24-56 × 1.4-2.0 μm, 1-4 septate, but mostly 3-septate, septa distinct.

Habitat: On living leaves of *Taraxacum* spp. (Asteraceae).

Specimens examined: SMK 11756 (3 VII 1992, Kangnung), 11763 (7 VII 1992, Pyongchnag), 12482 (26 VII 1993, Kangnung), 12916 (26 VI 1994, Jongsun), 13017 (14 IX 1994, Chongju), 13596 (26 VI 1995, Kangnung), 13825 (26 V 1997, Samchok), 13834 (26 V 1997, Samchok), 14497 (9 V 1998, Kangnung), 14615 (7 VI 1998, Yangku), 15177 (24 IX 1998, Pochon), 15242 (24 IX 1998, Kangnung), 15391 (8 X 1998, Suwon), 15561 (24 X 1998, Taegu).

Note: The size of conidiomata and conidia for this species given by various authors vary: 50-70 μm and 20-38 × 0.75-1 μm (Miura, 1928); 100-120 μm and 16-24 × 1 μm (Radulescu *et al.*, 1973); 50-115 μm and 17-50 × 1-2 μm (Lu, 1992); 100-120 μm and 16-40 × 1-1.5 μm (Vanev *et al.*, 1997); and 36-80 μm and 24-56 × 1.4-2.0 μm (present authors). The septation of conidia ranged from aseptate (Radulescu *et al.*, 1973) to 3-5-septate (Lu, 1992). We tentatively place our fungus in the oldest name, *S. taraxaci*. This is the first record of this species from Korea.

(30) *Septoria violae-palustris* Died., Krypt. Fl. M. Brandenb. 9(7): 522 (1914)

Phloeospora violae Westend., Bull. Acad. Roy. Sci. Belgique 12: 251, 1845; *Septoria violae* (Westend.) Westend., Crypt. Stat. Nat., p. 114, 1854, non Rabenh., 1850; *Septoria violae* Westend. var. *palustris* Grove, Brit. Stem- & Leaf-Fungi, 1, p. 417, 1935.

Conidiomata pycnidial, scattered to aggregated, amphigenous, mostly hypophyllous, dark brown to brown, globose, more or less immersed, unilocular, 56-144 ㎛ diam.; ostiole circular, 10-22 ㎛ wide. Conidia holoblastic, filiform, substraight to mildly curved, subtruncate at basal end, gently tapered towards the narrowly obtuse distal end, eguttulate, hyaline, 22-56 × 1.6-2.2 ㎛, 1-3-septate, septa distinct.

Habitat: On living leaves of *Viola verecunda* A. Gray (Violaceae).

Specimens examined: SMK 10752 (1 VI 1991, Kangnung), 12865 (8 VI 1994, Kangnung), 12900 (25 VI 1994, Kangnung), 12901 (25 VI 1994, Kangnung), 13582 (23 VI 1995, Kangnung).

Note: Three species of *Septoria* have been described on *Viola* spp., and they are discussed by Jørstad (1965). *S. violae-palustris* Died. was treated as a synonym of *S. violae* (Westend.) Westend. As *S. violae* Rabenh. is older than *S. violae* (Westend.) Westend., the later name is illegitimate, so the correct name for the present species is *S. violae-palustris* Died. Subsequent authors agree with Jørstad (Brandenburger, 1985; Vanev *et al.*, 1997). Shin (1998) recorded this species for the first time in Korea with providing a short description, and phytopathological notes.

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REFERENCES

Brandenburger, W. (1985). Parasitische Pilze an Gefäßpflanzen in Europa. G. Fischer Verlag, Stuttgart, New York. 1248 pp.

Bunkina, I. A. (1963). New species of fungi imperfecti for Primorsky region. Vkr. Bot. Zh. 20(6): 95-96.

Cho, W. D., Kim, W. K., Jee, H. J., Choi, H. S., Lee, S. D. and Choi, Y. C. (1997). Compendium of Vegetable Diseases. Natl. Inst. Agric. Sci. Tech., Korea. 447 pp.

Constantinescu, O. (1962). Contributii la cunoasterea speciilor de *Septoria* din micoflora R. P. R. Com. Acad. R.P.R. 12: 1319-1325.

Constantinescu, O. (1984). Taxonomic revision of *Septoria*-like fungi parasitic on Betulaceae. Trans. Brit. Mycol. Soc. 83: 383-398.

Forestry Research Institute. (1991). Insect Pests and Diseases of Trees and Shrubs. Seoul, Korea. 424 pp.

Grove, W. B. (1935). British Stem- and Leaf-Fungi (Coelomycetes). Vol.1. Cambridge Univ. Press, London. 488 pp.

Jørstad, I. (1965). Septoria and Septorioid Fungi on Dicotyledones in Norway. Oslo Univ. Press, Oslo, Norway. 110 pp.

Lee, E. J., Lee, Y. H., Cho, W. D., Kim, W. K. and Ryu, H. Y. (1989). Compendium of Ornamental Plant Diseases with Colour Plates. Agric. Sci. Inst., Korea. 201 pp.

Lu, G. Z. (1992). Studies on the Taxonomy of Main Genera and Species of Sphaeropsidales in Northeast China. Ph.D. Thesis, Shenyang Agric. Univ., China. 374 pp.

Miura, M. (1928). Flora of Manchuria and East Mongolia, III. Cryptogams, Fungi. South Manch.Railway Co. 549 pp.

Nakata, K. and Takimoto, K. (1928). List of diseases of cultivated plants in Korea. Bull. Agric. Exp. Stat. Korea 15: 1-146.

Park, J. S. (1958). Fungous Diseases of Plants in Korea (I). Spec. Bull. No. 1., Coll. Agric., Chungnam Nat. Univ. 106 pp.

Park, J. S. (1967). Fungous diseases of plants in Korea. Bull. Chungnam Nat. Univ. 6: 1-86.

Punithalingam, E. and Wheeler, B. E. J. (1965). *Septoria* spp. occurring on species of *Chrysanthemum*. Trans. Brit. Mycol. Soc. 48: 423-439.

Radulescu, E., Negru, Al. and Docea, E. (1973). Septoriozele din Romania. Bucuresti, Acad. Rep. Soc. Romania. 325 pp.

Sameva, E. F. (1987). Contribution to the study of the fungi from the genus *Septoria* Sacc. (Sphaeopsidales, Deuteromycetes) in Bulgaria. II. Fitologija 33: 44-52.

Sameva, E. F. (1991a). Contribution to the study of the fungi from the genus *Septoria* Sacc. (Sphaeopsidales, Deuteromycetes) in Bulgaria. III. Fitologija 39: 66-71.

Sameva, E. F. (1991b). Contribution to the study of the fungi from the genus *Septoria* Sacc. (Sphaeopsidales, Deuteromycetes) in Bulgaria. IV. Fitologija 40: 68-73.

Shin, H. D. (1994). New fungal diseases of economic resource plants in Korea (I). Kor. J. Plant Pathol. 10: 181-191.

Shin, H. D. (1995). New fungal diseases of economic resource plants in Korea (II). Kor. J. Plant Pathol. 11: 120-131.

Shin, H. D. (1998). New fungal diseases of economic resource plants in Korea (V). Kor. J. Plant Pathol. 14: 52-61.

Sutton, B. C. (1980). The Coelomycetes. Fungi Imperfecti with Pycnidia, Acervuli and Stromata. CMI, Kew. 696 pp.

Tehon, L. R. and Daniels, E. Y. (1927). Notes on the parasitic fungi of Illinois – III. Mycologia 19: 110-129.

Teterevnikova-Babayan, D. N. (1987). Fungi of genus *Septoria* in USSR. AS Armenian SSR, Erevan. 480 pp.

The Korean Society of Plant Pathology. (1998). List of Plant Diseases in Korea. 3rd ed. Suwon, Korea. 436 pp.

Vanev, S. G., Sameva, E. F. and Bakolova, G. G. (1997). Fungi Bulgaricae. 3 Tomus, Ordo Sphaeropsidales. Sofia, Bulgaria. 335 pp.

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FUNGI FROM THE DJA BIOSPHERE RESERVE (CAMEROON) II. POLYPORES

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Abstract

A preliminary survey of the polypores from the Dja Biosphere Reserve (Cameroon) is given. 23 species are reported new for Cameroon. Other important collections are the second world record of *Perenniporia dendrohyphidia*, the third world record of *Coltricia pyrophila*, first African record of *Oligoporus leucomallus*, and one of the few world records of *Ganoderma hildebrandii*.

Key words: Polypores, Dja Biosphere Reserve, Cameroon, biogeography.

INTRODUCTION

The Dja wildlife reserve is situated in eastern Cameroon, between 2°40' - 3°23'N and 12°25' - 13°35'E, surrounded by the Dja river (Fig. 1). It consists of 5.260 km² of dense and almost flat forest between the Biafra and Congo biogeographical areas. Three types of forests are encountered in the area: 1) Central African semideciduous forest in the N, 2) evergreen Congo basin forest in the SE, and 3) Atlantic Biafra forest in the W. Flooding zones are common throughout the area. Dja was declared wildlife reserve in 1950, and Biosphere reserve in 1981 (Ecofac web 1998).

African polypores are taxonomically fairly well known (Ryvarden & Johansen 1980, Ryvarden 1988, David & Rajchenberg 1992). Several papers are dedicated to their natural history and distribution in Africa (Morris 1990, Masuka & Ryvarden 1993, Renvall & Niemelä 1993, Ryvarden 1998), and few of them concentrate on Cameroonian species (Ryvarden & Núñez 1993, Núñez & Ryvarden 1993, Laessøe et al. 1996).

One of us (P.P.D.) had the opportunity to collect wild mushrooms (mostly polypores) during the dry season in 1997, at Somalomo village. Further collecting was undertaken at Bouamir, Schouam, Mbouma and Ngoulentana (see Fig.1). For Gasteromycetes of the Dja reserve see Calonge & Daniëls (1998).

MATERIAL AND METHODS

Basidiocarps were collected in paper bags by opportunistic sampling. They were dried, and identified with a light microscope, the tissue mounted in either 5% KOH or Melzer's reagent (Gilbertson & Ryvarden 1986). The material is preserved at the herbarium of the Real Jardín Botánico, Madrid (MA-Fungi) with duplicates at the ECOFAC project, Yaoundé, Cameroon.

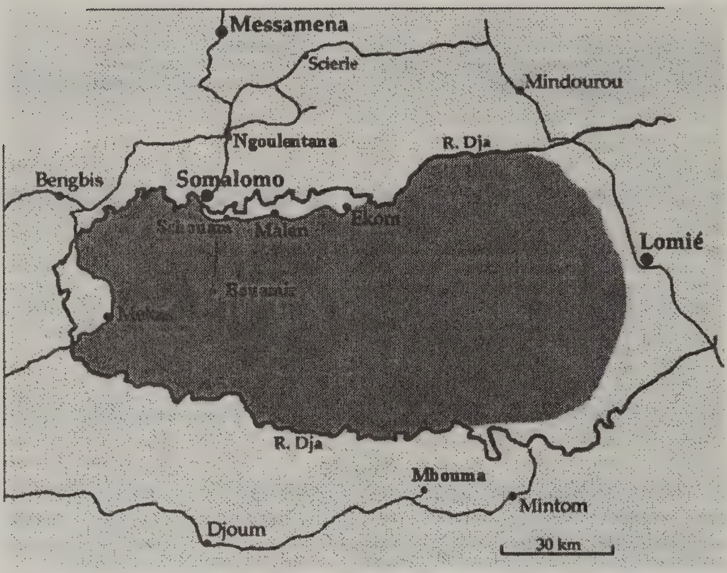

Fig.1 Map of the Dja Reserve.

LIST OF SPECIES

We identified 54 species of polypores from Dja reserve. Species have been grouped in families and listed alphabetically. Collecting data, the collection number at MA-fungi, and a reference to the species description are specified. Further, ethnobotanical data and/or taxonomic remarks are included if necessary. New records for Cameroon are marked with an asterisk (*).

CORTICIACEAE

*** *Gloeoporus croceo-pallens*** Bres.
Bouamir, km 2 from Bouamir to Somalomo, 12°48' E- 3°14'N, 660 m.a.s.l., 3/07/97, on *Uapaca*, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C93Daniëls, MA-Fungi 38203.
Ryvarden & Johansen (1980).
Distribution: Palaeotropical.

Grammothele fuligo (Berk. & Br.) Ryvarden
Bouamir, km 1.5 from Bouamir to Somalomo, 12°48' E- 3°14'N, 660 m.a.s.l., 3/07/97, on foliaceous axis of *Lacosperma secundiflorum*, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C95Daniëls, MA-Fungi 38205.
Ryvarden & Johansen (1980).
Distribution: Pantropical, common.

Porogramme albo-cincta (Cooke & Massee) Lowe
Bouamir, km 1.5 from Bouamir to Somalomo, 12°48' E- 3°14'N, 660 m.a.s.l., 3/07/97, on foliaceous axis of *Lacosperma secundiflorum*, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C98Daniëls, MA-Fungi 38206.
Ryvarden & Johansen (1980).
Distribution: Pantropical.

Schizopora flavipora (Cooke) Ryvarden
Schouam, path to the Schouam rock, 12°50' E- 3°20'N, 640 m.a.s.l., 28/06/97, on *Garcinia kola*, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C56Daniëls, MA-Fungi 38249; Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on wood, leg.: P.P. Daniëls, C135Daniëls, MA-Fungi 38220.
Gilbertson & Ryvarden (1987).
Distribution: Cosmopolitan, most common in the tropics.
Note: MA-Fungi 38249 is effused-reflexed, with a reddish pileus, and a pinkish pore surface. These characters fit with the morphological variation of the species (Kotlaba & Pouzar 1979).

GANODERMATACEAE

* ***Amauroderma infundibuliforme*** Wakef.
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on the ground, leg.: P.P. Daniëls & R. Nnamedoumou. C15bDaniëls, MA-Fungi 39375.
Ryvarden & Johansen (1980).
Distribution: Africa. First record for West Africa.

Amauroderma kwiluensis (Beeli) Ryvarden
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on the ground, leg.: P.P. Daniëls & R. Nnamedoumou. C30Daniëls, MA-Fungi 38240; Idem C4Daniëls, MA-Fungi 38177.
Ryvarden & Johansen (1980).
Distribution: Central Africa.

* ***Amauroderma sericatum*** (Lloyd) Wakef.
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on the ground, leg.: P.P. Daniëls & R. Nnamedoumou. C14Daniëls, MA-Fungi 38232; Idem, C15aDaniëls, MA-Fungi 38233.
Ryvarden & Johansen (1980).
Distribution: Central Africa.

* ***Ganoderma hildebrandii*** Henn.
Schouam, path to the Schouam rock, 12°50' E- 3°20'N, 640 m.a.s.l., 28/06/97, on the ground, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C54Daniëls, MA-Fungi 38248; Idem, C74Daniëls, MA-Fungi 38255.
Moncalvo & Ryvarden (1995).
Distribution: Africa, previously only known from the Comoro islands, South Africa and Liberia.
Note: Basidiocarps of MA-Fungi 38248 are laterally stipitate, and the pore surface is invariably light yellow, while the species is described as centrally stipitate with white to cream pore surface in Moncalvo & Ryvarden (op. cit.). Otherwise the basidiospores have the strong ornamentation typical for the species, a long, black stipe, and purple, glossy pilear surface.

Ganoderma lucidum s.l. (Fr.) P. Karst.
Bouamir, path to the Bouamir rock, 12°49' E- 3°14'N, 660 m.a.s.l., 2/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C86Daniëls, MA-Fungi 38261; Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C12Daniëls, MA-Fungi 38181; Somalomo, near the village, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on rotting wood, leg.: P.P. Daniëls & R. Nnamedoumou. C43Daniëls, MA-Fungi 38189.
Ryvarden & Johansen (1980), Moncalvo et al. (1995).

Distribution: Cosmopolitan.

* ***Ganoderma* cf. *multiplicatum*** (Mont.) Pat.
Bouamir, path to the Bouamir rock, 12°49' E- 3°14'N, 660 m.a.s.l., 2/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C87Daniëls, MA-Fungi 38262.
Steyaert (1980).
Distribution: Pantropical.
Note: This is a species in the *G. lucidum* group, characterized by an almost black pileus with a white margin, and a light brown context. A palisade of clavate, amyloid hyphae forms the pilear surface. Its relatively small basidiospores (7.5-8 x 6-6.5 µm) separate this species from the Asian *G. boninense* Pat. (Ryvarden 1983).

HYMENOCHAETACEAE

* ***Coltricia pyrophila*** (Wakef.) Ryvarden
Somalomo, margin of the Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 6/07/97, on the ground with charcoal and burnt wood, leg.: P.P. Daniëls. C119Daniëls, MA-Fungi 38265.
Ryvarden & Johansen (1980).
Distribution: West Africa, previously only known from Sierra Leone and Nigeria.

Phellinus allardii (Bres.) Ryvarden
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C10Daniëls, MA-Fungi 38180; C6Daniëls, MA-Fungi 38178. Somalomo, near the *Gilbertiodendron* forest, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C42Daniëls, MA-Fungi 38245; Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & C. Vautherin. C121Daniëls, MA-Fungi 38267.
Larsen & Cobb-Poulle (1990).
Distribution: Palaeotropical, common.

Phellinus callimorphus (Lév.) Ryvarden
Mbouma, near the path to Dja river, 13°5' E- 2°45'N, 600 m.a.s.l., 14/07/97, on wood, leg.: P.P. Daniëls. C188Daniëls, MA-Fungi 38286; Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C13Daniëls, MA-Fungi 38182.
Larsen & Cobb-Poulle (1990).
Distribution: Pantropical, most common in Africa.

Phellinus extensus (Lév.) Pat.
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C170Daniëls, MA-Fungi 38282.
Larsen & Cobb-Poulle (1990).
Distribution: Pantropical.

Phellinus gilvus (Schwein.) Pat.
Mbouma, near the village, path to Dja river, 13°5' E- 2°45'N, 630 m.a.s.l., 13/07/97, on *Mussanga scorpioides*, leg.: P.P. Daniëls. C173Daniëls, MA-Fungi 38283; Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C21Daniëls, MA-Fungi 38236.
Larsen & Cobb-Poulle (1990).
Distribution: Pantropical, common.

* ***Phellinus glaucescens*** (Petch) Ryvarden
Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & C. Vautherin. C120Daniëls, MA-Fungi 38266.
Larsen & Cobb-Poulle (1990).
Distribution: Palaeotropical.

* ***Phellinus nilgheriensis*** (Mont.) G. Cunn.
Somalomo, near the *Gilbertiodendron* forest, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on wood, leg.: P.P. Daniëls & R. Nnamedoumou. C49Daniëls, MA-Fungi 38247; Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on *Baillonella toxisperma*, leg.: Ch. Ndjankoum. C132Daniëls, MA-Fungi 38272; Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C34Daniëls, MA-Fungi 38243.
Larsen & Cobb-Poulle (1990).
Distribution: Pantropical.
Note: MA-Fungi 38247 was about 30cm in diameter when collected.

* ***Phellinus pectinatus*** (Kl.) Quél.
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C2Daniëls, MA-Fungi 38175.
Larsen & Cobb-Poulle (1990).
Distribution: Pantropical.

Phellinus senex (Nees & Mont.) Imaz.
Ngoulentana, path towards Dja river, 12°49' E- 3°28'N, 680 m.a.s.l., 8/07/97, on *Petersantus macrocarpus*, leg.: P.P. Daniëls, R. Nnamedoumou, C. Vautherin, J.J. Avoto, D. Soko. C154Daniëls, MA-Fungi 38277; Schouam, path towards the Schouam rock, 12°50' E- 3°20'N, 640 m.a.s.l., 28/06/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C68Daniëls, MA-Fungi 38253; Idem, C69Daniëls, MA-Fungi 38254; Idem, C79Daniëls, MA-Fungi 38257.
Larsen & Cobb-Poulle (1990).
Distribution: Pantropical, one of the most common species in Dja.
Note: The Baka pygmies refer to this species as "Tulu Boso".

Phylloporia spathulata (Hook) Ryvarden
Schouam, Schouam rock, 12°50' E- 3°19N, 650 m.a.s.l., 28/06/97, on the ground, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C55Daniëls, MA-Fungi 38193.
Ryvarden & Johansen (1980).
Distribution: Pantropical.

POLYPORACEAE

* ***Antrodiella hydrophila*** (Berk. & M.A. Curtis) Ryvarden
Somalomo, in a *Gilbertiodendron dewevrei* forest, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C40Daniëls, MA-Fungi 38188.
Ryvarden & Johansen (1980), Ginns (1980).
Distribution: Pantropical, common. New record for West Africa.

Coriolopsis caperata (Berk.) Murrill
Mbouma, near the path to Dja river, 13°5' E- 2°45'N, 600 m.a.s.l., 14/07/97, on wood, leg.: P.P. Daniëls. C191Daniëls, MA-Fungi 38228; Schouam, path towards the Schouam rock, 12°50' E-

3°20'N, 640 m.a.s.l., 28/06/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C70Daniëls, MA-Fungi 38196.
Ryvarden & Johansen (1980).
Distribution: Pantropical, common.

Coriolopsis helvola (Fr.) Ryvarden
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C16Daniëls, MA-Fungi 38234.
Ryvarden & Johansen (1980).
Distribution: West Africa.

Coriolopsis polyzona (Pers.) Ryvarden
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C22Daniëls, MA-Fungi 38183.
Ryvarden & Johansen (1980).
Distribution: Pantropical, common.

* ***Coriolopsis sanguinaria*** (Kl.) Teng
Bouamir-Somalomo, km 8'5 of the path, 12°48' E- 3°16'N, 660 m.a.s.l., 4/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C111Daniëls, MA-Fungi 38212; Idem, C108Daniëls, MA-Fungi 38211; Somalomo, near the village, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on burnt wood, leg.: P.P. Daniëls & R. Nnamedoumou. C36Daniëls, MA-Fungi 38244.
Ryvarden & Johansen (1980).
Distribution: Pantropical, most common in the palaeotropics.

Earliella scabrosa (Pers.) Gilb. & Ryvarden
Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & C. Vautherin. C130Daniëls, MA-Fungi 38219; Idem, C136Daniëls, MA-Fungi 38221.
Ryvarden & Johansen (1980).
Distribution: Pantropical, common.

* ***Fomitopsis carnea*** (Blume & Nees) Imaz.
Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on wood, leg.: P.P. Daniëls. C133Daniëls, MA-Fungi 38273.
Ryvarden & Johansen (1980).
Distribution: Palaeotropical.

* ***Hexagonia pobequini*** Hariot
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C169Daniëls, MA-Fungi 38281.
Ryvarden & Johansen (1980).
Distribution: Africa.

Hexagonia tenuis (Hook.) Fr.
Bouamir-Somalomo, km 15.5 of the path, 12°48' E- 3°18'N, 650 m.a.s.l., 4/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C114Daniëls, MA-Fungi 38214; Bouamir, km. 2.5 from Bouamir to Somalomo, 12°48' E- 3°14'N, 660 m.a.s.l., 3/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C101Daniëls, MA-Fungi 38207.
Ryvarden & Johansen (1980).

Distribution: Pantropical, common.

Hexagonia* cf. *umbrinella Fr.
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C7Daniëls, MA-Fungi 38231.
Ryvarden & Johansen (1980).
Distribution: Palaeotropical.
Note: MA-Fungi 38231was sterile.

Lenzites elegans (Fr.) Pat.
Schouam, path towards the Schouam rock, 12°50' E- 3°20'N, 640 m.a.s.l., 28/06/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C75Daniëls, MA-Fungi 38198; Somalomo, near the *Gilbertiodendron* forest, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on wood, leg.: P.P. Daniëls & R. Nnamedoumou. C46Daniëls, MA-Fungi 38190; Somalomo, near the village, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C37Daniëls, MA-Fungi 38186.
Ryvarden & Johansen (1980).
Distribution: Pantropical to subtropical, common.

* ***Loweporus inflexibilis*** (Berk.) Ryvarden
Ngoulentana, path towards Dja river, 12°49' E- 3°28'N, 680 m.a.s.l., 8/07/97, on *Asthonia boniae*, leg.: P.P. Daniëls, R. Nnamedoumou, C. Vautherin, J.J. Avoto, D. Soko. C147Daniëls, MA-Fungi 38224.
Ryvarden & Johansen (1980).
Distribution: Pantropical.

Microporus albo-ater (Henn.) Kunt.
Bouamir, near Calao project camp, 12°49' E- 3°14'N, 660 m.a.s.l., 2/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C83Daniëls, MA-Fungi 38199; Bouamir, km 2 from Bouamir to Somalomo, 12°48' E- 3°14'N, 660 m.a.s.l., 3/07/97, on wood of *Desbordesia glaucescens*, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C104Daniëls, MA-Fungi 38209; Schouam, path towards the Schouam rock, 12°50' E- 3°20'N, 640 m.a.s.l., 28/06/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C77Daniëls, MA-Fungi 38256.
Ryvarden & Johansen (1980).
Distribution: Africa.

Microporus vernicipes (Berk.) Kunt.
Bouamir, km 2 from Bouamir to Somalomo, 12°48' E- 3°14'N, 660 m.a.s.l., 3/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C103Daniëls, MA-Fungi 38208.
Ryvarden & Johansen (1980).
Distribution: Palaeotropical to subtropical.

Microporus xanthopus (Fr.) Kunt.
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C33Daniëls, MA-Fungi 38184; Idem, C26Daniëls, MA-Fungi 38239; Somalomo, near the *Gilbertiodendron* forest, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on wood, leg.: P.P. Daniëls & R. Nnamedoumou. C48Daniëls, MA-Fungi 38191.
Ryvarden & Johansen (1980).
Distribution: Palaeotropical.

Nigroporus vinosus (Berk.) Murrill
Bouamir-Somalomo, km 3 of the path, 12°48' E- 3°14'N, 660 m.a.s.l., 4/07/97, on *Uapaca paludosa*, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C113Daniëls, MA-Fungi 38213; Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C24Daniëls, MA-Fungi 38238.
Ryvarden & Johansen (1980).
Distribution: Pantropical to subtropical, common.
Note: MA-Fungi 38238 is stipitate, but otherwise typical with a thin, flat pileus and a pinkish pore surface.

* ***Oligoporus subcaesius*** (A. David) Ryvarden & Gilb.
Mbouma, near the village, towards Dja river, 13°5' E- 2°45'N, 630 m.a.s.l., 13/07/97, on wood, leg.: P.P. Daniëls. C176Daniëls, MA-Fungi 38284.
Ryvarden & Gilbertson (1994).
Distribution: Mostly temperate. First record for West Africa.
Note: *O. africanus* Ryvarden, a similar species in the *O. caesius*-group, has a glabrous, brown pilear surface with a distinct cartilaginous crust at the base, and smaller basidiospores (Ryvarden 1988). MA-Fungi 38284 had a white to greyish, pubescent pilear surface, and basidiospore sizes were 3.5-4.1(4.3) x 0.9-1 µm, slightly shorter than those given for *O. subcaesius* (4-5 x 1-1.2 µm, Ryvarden & Gilbertson 1994). Differences in basidiospore size are so minimal that we decide to give more importance to the overall appearance of basidiocarps, and identify MA-Fungi 38284 as *O. subcaesius.* The species has been found in tropical areas before (Suhirman & Núñez 1998).
Oligoporus subcaesius can be an introduced species in Africa, as the collection was found near an urban area. Introduced species in the African polypore flora is a well-known phenomenon (Masuka & Ryvarden 1993).

* ***Oxyporus latemarginatus*** (Dur. & Mont.) Donk
Ngoulentana, path towards Dja river, 12°49' E- 3°28'N, 680 m.a.s.l., 8/07/97, on *Tasmania africana*, leg.: P.P. Daniëls, R. Nnamedoumou, C. Vautherin, J.J. Avoto, D. Soko. C151Daniëls, MA-Fungi 38276.
Ryvarden & Johansen (1980).
Distribution: Cosmopolitan.

* ***Perenniporia dendrohyphidia*** Ryvarden
Somalomo, in a *Gilbertiodendron dewevrei* forest, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on wood, leg.: P.P. Daniëls & R. Nnamedoumou. C45Daniëls, MA-Fungi 38246.
Ryvarden (1988).
Distribution: Africa, previously only known from the holotype locality in Burundi. Second world record and new to West Africa.
Note: MA-Fungi 38246 deviates from the holotype in the pore surface colour, which is white in the Dja specimen, only ochre when old. The hyphae are not olivaceous in KOH, a character remarked as typical by Ryvarden (op. cit.). Otherwise, the presence of dendrohyphidia in the dissepiments and mammillate cystidiols in the hymenium, the basidiospore size and shape, and its resupinate habit are typical for *P. dendrohyphidia.*

Perenniporia ochroleuca (Berk.) Ryvarden
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C8Daniëls, MA-Fungi 38179.
Ryvarden & Johansen (1980).
Distribution: Cosmopolitan, most common in the tropics.

* ***Perenniporia tephrophora*** (Mont.) Ryvarden
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C23Daniëls, MA-Fungi 38237; Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on wood, leg.: P.P. Daniëls. C134Daniëls, MA-Fungi 38274.
Ryvarden & Johansen (1980).
Distribution: Pantropical, common.

Polyporus centroafricanus Núñez & Ryvarden
Bouamir, km 2 from Bouamir to Somalomo, 12°48' E- 3°14'N, 660 m.a.s.l., 3/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C92Daniëls, MA-Fungi 38202.
Núñez & Ryvarden (1995).
Distribution: Africa, the Congo basin.

* ***Polyporus leprieurii*** Mont.
Ngoulentana, path towards Dja river, 12°49' E- 3°28'N, 680 m.a.s.l., 8/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, C. Vautherin, J.J. Avoto & D. Soko. C143Daniëls, MA-Fungi 38275.
Núñez & Ryvarden (1995).
Distribution: Tropical, most common in the neotropics.
Note: The species is usually identified as *Polyporus hemicapnodes* Berk. & Br. in Africa. The Baka pygmies refer to this species as " Mawaluwalu", edible when boiled.

Polyporus philippinensis Berk.
Ngoulentana, path towards Dja river, 12°49' E- 3°28'N, 680 m.a.s.l., 8/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, C. Vautherin, J.J. Avoto & D. Soko. C163Daniëls, MA-Fungi 38278.
Núñez & Ryvarden (1995).
Distribution: Tropical to subtropical, more common in the palaeotropics.

Polyporus tenuiculus (Beauv.) Fr.
Mbouma, near the path to Dja river, 13°5' E- 2°45'N, 600 m.a.s.l., 14/07/97, on wood, leg.: P.P. Daniëls. C186Daniëls, MA-Fungi 38227; Ngoulentana, path towards Dja river, 12°49' E- 3°28'N, 680 m.a.s.l., 8/07/97, on *Margaritaria discordea*, leg.: P.P. Daniëls, R. Nnamedoumou, C. Vautherin, J.J. Avoto & D. Soko. C139Daniëls, MA-Fungi 38222; Idem, on wood of *Mussanga scorpioides*, C155Daniëls, MA-Fungi 38226; Schouam, near the village, 12°50' E- 3°21'N, 640 m.a.s.l., 28/06/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C63Daniëls, MA-Fungi 38195; Somalomo, near *Gilbertiodendron* forest, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C39Daniëls, MA-Fungi 38187; Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & C. Vautherin. C125Daniëls, MA-Fungi 38218.
Núñez & Ryvarden (1995).
Distribution: Pantropical, common.
Note: The Baka pygmies refer to this species as " tulu lokaka" or " sakusa ", edible when boiled.

* ***Polyporus virgatus*** Berk. & M.A. Curtis
Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & C. Vautherin. C127Daniëls, MA-Fungi 38269.

Núñez & Ryvarden (1995).
Distribution: Pantropical to subtropical, more common in Africa.

Pycnoporus sanguineus (Fr.) Murrill
Somalomo, near the village, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on burnt wood, leg.: P.P. Daniëls & R. Nnamedoumou. C50Daniëls, MA-Fungi 38192.
Ryvarden & Johansen (1980).
Distribution: Pantropical, common.

Rigidoporus lineatus (Pers.) Ryvarden
Bouamir, near Calao project camp, 12°49' E- 3°14'N, 660 m.a.s.l., 2/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C85Daniëls, MA-Fungi 38201; Schouam, path towards the Schouam rock, 12°50' E- 3°20'N, 640 m.a.s.l., 28/06/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C167Daniëls, MA-Fungi 38280; Schouam, near the village, 12°50' E- 3°21'N, 640 m.a.s.l., 28/06/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & M. Olé. C59Daniëls, MA-Fungi 38194; Somalomo, near the village, 12°45' E- 3°23'N, 640 m.a.s.l., 7/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou & C. Vautherin. C123Daniëls, MA-Fungi 38217.
Ryvarden & Johansen (1980).
Distribution: Pantropical, common.

Rigidoporus microporus (Fr.) Overeem
Bouamir, near Calao project camp, 12°49' E- 3°14'N, 660 m.a.s.l., 2/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C84Daniëls, MA-Fungi 38200; Bouamir-Somalomo, km 4 of the path, 12°48' E- 3°15'N, 660 m.a.s.l., 4/07/97, on trunk, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C107Daniëls, MA-Fungi 38210.
Ryvarden & Johansen (1980).
Distribution: Pantropical, common.

Tinctoporellus epimiltinus (Berk. & Br.) Ryvarden
Ngoulentana, path towards Dja river, 12°49' E- 3°28'N, 680 m.a.s.l., 8/07/97, on *Asthonia boniae*, leg.: P.P. Daniëls, R. Nnamedoumou, C. Vautherin, J.J. Avoto & D. Soko. C149Daniëls, MA-Fungi 38225.
Ryvarden & Johansen (1980).
Distribution: Pantropical, common.

*** *Trametes cingulata*** Berk.
Somalomo, near the village, 12°44' E- 3°23'N, 640 m.a.s.l., 27/06/97, on burnt wood, leg.: P.P. Daniëls & R. Nnamedoumou. C35Daniëls, MA-Fungi 38185.
Ryvarden & Johansen (1980).
Distribution: Palaeotropical.

*** *Trichaptum durum*** (Jungh.) Corner
Bouamir-Somalomo, km 6 of the path, 12°48' E- 3°15'N, 660 m.a.s.l., 4/07/97, on wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum. C116Daniëls, MA-Fungi 38215.
Corner (1987).
Distribution: Pantropical to subtropical.

* ***Tyromyces leucomallus*** (Berk. & M.A. Curtis) Murr.
Bouamir, km 1 from Bouamir to Somalomo, 12°48' E- 3°14'N, 660 m.a.s.l., 3/07/97, on dead wood, leg.: P.P. Daniëls, R. Nnamedoumou, J. Ebeh, P. Abate & Ch. Ndjankoum.
C106Daniëls, MA-Fungi 38264.
Gilbertson & Ryvarden (1987).
Distribution: Tropical to subtropical. New for Africa.

* ***Wrightoporia tropicalis*** (Cooke) Ryvarden
Somalomo, near Dja river, 12°45' E- 3°23'N, 640 m.a.s.l., 26/06/97, on rotten wood, leg.: P.P. Daniëls & R. Nnamedoumou. C166Daniëls, MA-Fungi 38279.
Ryvarden & Johansen (1980).
Distribution: Pantropical.

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LITERATURE CITED

Calonge, F.D. & Daniëls, P.P. 1998: Fungi of the Dja Biosphere Reserve. Notes on some Gasteromycetes. Bol. Soc. Micol. Madrid 23:135-138.

Corner, E.J.H. 1987: Ad Polyporaceas IV. J. Cramer, Stuttgart.

David, A. & Rajchenberg, M. 1992: West African polypores: New species and combinations. Mycotaxon 45:131-148.

Ecofac web. 1998: http://www.ecofac.org/Composantes/CamerounDja.htm

Gilbertson, R.L. & Ryvarden, L. 1986-87: North American polypores. Vol 1 and 2. Fungiflora, Oslo.

Ginns, J. 1980: The genus *Flaviporus* Murrill (Polyporaceae). Can. J. Bot. 58:1578-1590.

Kotlaba, F. & Pouzar, Z. 1979: *Schizopora carneo-lutea*, mycogeographically interesting species of fungi (Corticiaceae). Ceská Mykologie 33:19-35.

Laessøe, T., Ryvarden, L., Watling, R. & Whalley, A.J.S. 1996: Saprotrophic fungi of the Guinea-Congo region. Proc. Roy. Soc. Edinburgh 104B:335-347.

Larsen, M.J. & Cobb-Poulle, L.A. 1990: *Phellinus* (Hymenochaetaceae). A survey of the world taxa. Fungiflora, Oslo.

Masuka, A. & Ryvarden, L. 1993: Aphyllophorales on Pinus and Eucalyptus in Zimbabwe. Mycotaxon 44:243-250.

Moncalvo, J.M. & Ryvarden, L. 1995: *Ganoderma hildebrandii*, a forgotten species. Mycotaxon 56:175-180.

Moncalvo, J.M., Wang, H.F. & Hseu, R.S. 1995: Gene phylogeny of the *Ganoderma lucidum* complex. Comparison with traditional taxonomic characters. Mycol. Res. 99:1489-1499.

Morris, B. 1990: An annotated checklist of the macrofungi of Malawi. Kirkia 13:323-364.

Núñez, M. & Ryvarden, L. 1993: Basidiomycetes in the canopy and on twigs at the ground level: a comparison. In: Aspects of Tropical Mycology: 307. Ed. S. Isaac, J.C. Frankland, R. Watling & A.J.S. Whalley. Cambridge University Press.

Núñez, M. & Ryvarden, L. 1995: Polyporus (Basidiomycotina) and related genera. Fungiflora, Oslo.

Renvall, P. & Niemelä, T. 1993: *Ocotea usambarensis* and its fungal decayers in natural stands. Bull. Jard. Bot. Nat. Belg. 62:403-414.

Ryvarden, L. 1983: Type studies in the Polyporaceae 14. Species described by N. Patouillard, either alone or with other mycologists. Occ. Pap. Farlow Herb. 18:1-39.

Ryvarden, L. 1988: Two new polypores from Burundi in Africa. Mycotaxon 31:407-409.

Ryvarden, L. 1998: African polypores - A review. Belg. Journ. Bot. 131(2):150-155.

Ryvarden, L. & Gilbertson, R.L. 1994: European Polypores 2:394-743. Fungiflora, Oslo.

Ryvarden, L. & Johansen, I. 1980: A preliminary polypore flora of East Africa. Fungiflora, Oslo.

Ryvarden, L. & Núñez, M. 1993: Basidiomycetes in the canopy of an African rainforest. In: Biologie d'une canopée de fort équatoriale II: 116-118. Ed. F. Hallé & O. Pascal.

Steyaert, R.L. 1980: Study of some *Ganoderma* species. Bull. Jard. Bot. Nat. Belg. 50:135-186.

Suhirman & Núñez, M. 1998: Indonesian Aphyllophorales 3. Poroid and stereoid species from Kerinci-Seblat National Park, western Sumatra. Mycotaxon 68:273-292.

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TAXONOMIC SUMMARY AND RECONSIDERATION OF THE GENERIC CONCEPT OF DICTYUCHUS

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ABSTRACT

The main purpose of this study is to evaluate the efficacy of a broad versus restrictive generic concept of *Dictyuchus* (Saprolegniaceae, Oomycetes). The generic concept of *Dictyuchus* has from the beginning focused on the retention in the sporangium of a network formed by the appressed primary spore-cyst walls. However, the concept has evolved from a simple definition, based on a single species with true-net sporangia (lacking intersporal spaces), to a polymorphic concept also encompassing taxa with false-net sporangia (exhibiting intersporal spaces). Sporangial structure and mode of spore release, characteristics important to the generic concept, are not uniform in the genus as it has become recognized; some isolates exhibit considerable sporangial and other morphological variations. Herein, we first clarify the publication date of *Dictyuchus* and the original species, noting orthographic or authorship corrections on several species names, and account for species and varietal names published under the genus. We next address the generic concept. Functional implications of spore-cyst mutual adhesion and germination, coupled with the usual retention of sporangial form (including the cyst-wall network) in *Dictyuchus*, suggest that a broad-based generic concept (including both true-net and false-net species) is tenable. This conclusion is supported by certain lines of evidence, which we discuss. Additional ultrastructural and molecular studies may further resolve questions concerning the generic delimitation of *Dictyuchus*.

TAXONOMIC HISTORY OF THE GENUS

Leitgeb (1868) established the genus *Dictyuchus* using the net-like sporangium to distinguish it from other genera of the Saprolegniaceae, particularly *Achlya.* Later in a more complete discussion, Leitgeb (1869-70) applied the name *D. monosporus* to the only species of *Dictyuchus* then known. Although in his extensive writings on *Dictyuchus* Cornu (1872) gave Leitgeb credit for describing the genus and original species, he noted that F.J.F. Meyen, prior to Leitgeb, observed "dictyosporanges" in a purported *Achlya* species. Regardless, Leitgeb is the author of the generic name *Dictyuchus.*

The date of Leitgeb's publication of the genus has usually been cited as 1868 (e.g., Humphrey, 1893; Coker, 1923; Sparrow, 1960). However, several authors (Weston, 1919; Wolf, 1944; Khulbe and Sati, 1983) listed Leitgeb (1869) as the formal publication of the genus name. Coker and Matthews (1937) cited Leitgeb 1868 and 1869 for publication of *Dictyuchus,* without preference for date. Additionally Fischer (1892) indicated 1870 as the date of generic publication. The question about date of valid publication of *Dictyuchus* can be resolved by reference to Articles 41, 42, 43 of the

ICBN (1994). A genus name may be legitimately published without a species, although the reverse is not necessarily true (Article 41.3, example 3; Article 43.1, example 1). Leitgeb (1868) is thus the valid publication of the generic name *Dictyuchus* (cf. Minden, 1915; ING, 1979).

The date of valid publication of the species name *D. monosporus* is variously given, as 1869 (e.g., Johnson, 1951) and 1870 (e.g., ING, 1979). Examination of the title page of volume seven of *Jahrbucher fur Wissenschaftliche Botanik*, which lists the coverage date as 1869-70, explains the confusion over the publication of the species name. The article ("Neue Saprolegnieen") in which *D. monosporus* is published does not bear a more specific date; although one might guess the date of 1870 from the pagination (p. 357-389), a citation of 1869-70 for publication of the species is the most certain citation. The type of *D. monosporus* is the type of the genus (cf. Article 10.1, ICBN, 1994); Leitgeb's (1869-70) Plates 22 and 23 may be accepted as the type of *D. monosporus* (cf. Articles 7.11, 8.3, 9.1, ICBN, 1994).

In 1882 Busgen described *Dictyuchus clavatus*, though crediting recognition of the species to de Bary. De Bary's (1888) posthumous publication, edited by Solms-Laubach, highlighted *D. clavatus* as a possible distinct genus. Humphrey (1893) named this genus *Thraustotheca* (see Blackwell and Powell, 1993), transferring the epithet, viz., *T. clavata* (de Bary ex Busgen) Humphrey. Humphrey distinguished *Thraustotheca* by "the breaking up of the very fragile sporangial wall" to potentially free encysted zoospores, which might remain temporarily in a quasi net-like mass. In *Dictyuchus,* Humphrey (1893) recognized: *D. magnusii, D. monosporus,* and *D. polysporus,* which date to authorships prior to Humphrey's publication and correspond to three among Minden's (1915) and Coker's (1923) lists. Coker (1923) recognized five species of *Dictyuchus: D. sterile* (*sphalm.* for *sterilis)* Coker, *D. magnusii* Lindstedt, *D. monosporus* Leitgeb, *D. carpophorus* Zopf, and *D. polysporus* Lindstedt. Harvey (1930), in his survey of "watermolds" isolated from soil, followed Coker's use of names, recognizing *D. "sterile"* and *D. magnusii.*

Following a study of heterothallism in *Dictyuchus* (Couch, 1926), Couch (1931) summarized *Dictyuchus* species, with only *D. monosporus* held in common with Coker's (1923) list of species. Of the four species Couch (1931) recognized , *D. monosporus* possessed sporangia of the "true-net" type; whereas, *D. achlyoides* "Coker and Alexander" (1927), *D. pseudodictyon* "Coker and Braxton" (1926), and *D. missouriensis* Couch (1931) exhibited "false-net" sporangia. Although Couch (1931) cited authorship of *D. achlyoides* as "Coker and Alexander," this name should be attributed solely to Coker (1927); *D. achlyoides* was collected on Alexander's farm, but not named by him. Author citation of *D. pseudodictyon* should be Coker ex Couch (1931), since Couch published the name, although crediting it to Coker (cf. ICBN, 1994, Article 46.4, 46.6); apparently based on the assigned credit (to Coker) by Couch, Johnson et al. (1951) mistakenly concluded that Coker was the publishing author. Coker and Braxton (1926) initially described "*Dictyuchus* sp.," which became *D. pseudodictyon* in Couch (1931).

Revisionary work on the Saprolegniaceae after Couch (1931) usually followed Couch's use of names for species of *Dictyuchus* (e.g., Coker and Matthews, 1937). This was generally true as well in floristic (sampling) work (e.g., Ziegler, 1958; Klich and Tiffany, 1985). However, in some instances, certain names employed by Coker (1923), but not by Couch (1931), continued to be used in sampling studies, e.g., El-Nagdy and Abdel-Hafez (1990).

As to the disposition of *Dictyuchus* species names, Coker and Matthews' (1937) revision of *Dictyuchus,* as a part of their larger coverage of the Saprolegniaceae, provided information on the taxonomic fate of certain species recognized by Humphrey (1893) and Coker (1923). Coker and Matthews (1937) listed *D. "sterile"* Coker (= *D. sterilis*) as a synomym of *D. monosporus*; *D. sterilis* represents an asexual strain of *D. monosporus*. Coker and Matthews (1937) likewise relegated *Dictyuchus carpophorus* to the synonymy of *D. monosporus*. Fitzpatrick (1930) and Coker and Matthews (1937) considered *D. polysporus* Lindstedt, with multiple oospores per oogonium, doubtful as a species of *Dictyuchus;* the latter authors referenced a possible placement of *D. polysporus* in the genus *Protoachlya*. Lindstedt's (1872) original plates (II and III) of *D. polysporus* are, however, suggestive of the possible existence of a species of *Dictyuchus* with multiple oospores per oogonium. Among the earlier described *Dictyuchus* taxa, an attempt to reisolate Lindstedt's *D. polysporus* would be a worthwhile undertaking. Coker and Matthews (1937) did not mention *D. magnusii,* also described by Lindstedt (1872). However, Coker earlier (1923), though recognizing *D. magnusii,* expressed doubt that it was a "good species," and questioned its alleged differences from *D. monosporus* (to which it appears to belong). Coker and Matthews (1937), in fact, recognized the same four species of *Dictyuchus* as did Couch (1931), viz., *D. monosporus, D. achlyoides, D. missouriensis,* and *D. pseudodictyon*. Coker and Matthews (1937) treated a recently described species, *D. anomalus* Nagai (1931) from Japan, as a synonym of *D. monosporus*. Some later authors (Howard et al., 1970; Padgett and Seymour, 1974; Armbruster and Johnson, 1983; Khulbi and Sati, 1983) accepted *D. anomalus* as an additional species of the "true-net" type. However, since Nagai (1931) distinguished his "parthenogenetic form," i.e. *D. anomalus*, from typical *D. monosporus* primarily by the absence of antheridia, it is interpreted as a parthenogenetic strain of *D. monosporus*. Beneke (1948) added another "false-net" species, *D. pseudoachlyoides*. Padgett and Seymour (1974) remarked that Beneke (1948) described false-net sporangia in *D. pseudoachlyoides* but illustrated sporangia of the true-net type (Beneke's Figs. 1 and 2 of Plate 30). Our examination of Beneke's (1948) paper confirms Padgett and Seymour's (1974) interpretation. Sparrow (1960) summarized information on *Dictyuchus,* citing Coker and Matthews (1937) and Beneke (1948). Toma (1970) described a supposed variety of *D. missouriensis* Couch, viz. *D. missouriensis* var. *moruzii,* from Rumania. Toma's description of var. *moruzii* is troubling in that the sporangium does not retain a cyst-wall network; a residual cyst-wall network is evident (though not identical) in both the true- and false-net taxa of *Dictyuchus*. It is possible that "var. *moruzii"* would be better placed in another genus, such as *Brevilegnia,* to which it is identifiable, for example, in Sparrow (1960). Dick (1973) provided an update on the Saprolegniaceae, enumerating possible species of *Dictyuchus,* none being new. Chiou and Chang (1976) transferred *Brevilegnia variabilis* to *Dictyuchus,* a judgment accepted by Langsam (1987). Chiou and Chang (1976) discussed and illustrated *D. variabilis* as having sporangia of the true-net (and achlyoid) type, although relating it most closely to *D. pseudoachlyoides* Beneke, a putative false-net (and achlyoid) taxon; however, the net characteristics of *D. pseudoachlyoides* are, as indicated, debatable. Rai and Misra (1978) described *D. lucknowensis* as also having "true net" and, more rarely, "achlyoid" sporangia, and indicated that its closest relationship is also with *D. pseudoachlyoides*. If *D. pseudoachlyoides* is definitely determined to produce true-net sporangia, both *D. variabilis* and *D. lucknowensis* may eventually be transferred to this taxon. The alleged fish parasite, *Dictyuchus pisci* Khulbe and Sati (1983), is, based on the morphology of the true-net sporangium and oogonium, suggestive of *D. monosporus*.

DEVELOPMENT OF THE GENERIC CONCEPT

Leitgeb's (1868, 1869-70) concept of *Dictyuchus* was that of distinguishing a single, unequivocal taxon *(D. monosporus),* possessing what we would now call a "true-net" sporangium, from *Achlya*. Couch's (1931) flexible concept of the *Dictyuchus* sporangium, based on four species (three with false-net sporangia), was important to subsequent understanding of the genus (cf. Johnson, 1951). As distinguished from the "true-net" sporangium, containing somewhat compressed encysted spores without intersporal space, the "false-net" sporangium (Fig.1) is characterized by appressed but more rounded encysted spores with intersporal space evident, and a tendency for spore cyst separation (related to disintegration of the sporangial wall) under external pressure (e.g., a cover-slip pressed on the mount). All false-net species of *Dictyuchus* (Couch, 1931), especially *D. achlyoides,* can also undergo achlyoid sporangial development, at least under particular conditions. In achlyoid discharge, generally typical of the genus *Achlya*, all spores empty through the sporangial apex, forming a ball-like cluster, leaving no cyst-wall residuum within the sporangium (cf. Bonner, 1952; Johnson, 1956). Conversely, Couch (1931) noted that certain *Achlya* species, though typically achlyoid, could form a false-net sporangium, the spores escaping individually, instead of as a spore mass encysting just beyond the sporangial apex (cf. also Johnson, 1956). However, Couch (1931) considered the sporangial wall of *Achlya* to be more persistent than in *Dictyuchus*; he also considered the wall of true-net *Dictyuchus* sporangia to be more persistent than that of false-net sporangia. Armbruster and Johnson (1983) later substantiated these observations in an electron microscopic study of sporangial walls.

Couch (1931) encompassed both true-net (e.g., *D. monosporus*) and false-net (e.g., *D. pseudodictyon*) taxa of *Dictyuchus* in his treatment of the genus. The concept of *Dictyuchus* employed by Couch was, thus, apparently two-parted. However, Johnson (1951) considered that Couch's (1931) investigation had revealed not just two but three groups of *Dictyuchus* taxa based on the sporangium: (1) true-net, achlyoid sporangia not evident; (2) false-net, achlyoid sporangia infrequent (not present under usual circumstances); and (3) false-net, but achlyoid sporangia common (in relatively young cultures).

Characters employed to distinguish the putative subgroupings of *Dictyuchus*--sporangial wall persistence, the precise nature of the cyst-wall network, sporangial development, and, relatedly, possible mode of spore release--seem as substantial as those separating genera of the family, such as *Thraustotheca* or *Brevilegnia*. The deciduous sporangium of *D. monosporus* is, however, paralleled in *D. pseudodictyon.* Also, sporangia of both true- and false-net taxa may be branched. Hence, characters of sporangial branching and abscission in *Dictyuchus* may be unifying rather than divisive.

The particular character of the sporangial network was assumed to be correlated with other sporangial or species features, such as absence of achyloid release in taxa with true-net sporangia, and the potential of such release in taxa with false-net sporangia. Johnson (1951), however, found a strain of *Dictyuchus, "Dictyuchus* 521," which had true-net sporangia, yet could, particularly at younger stages, exhibit achlyoid sporangia; as the colony aged, a preponderance of false-net sporangia was observed. Hence, Johnson's discovery of this strain blurred apparent infrageneric categories in *Dictyuchus.* Although exhibiting unusual features, such as a profusely branched antheridal structure, Johnson (1951) did not give *"Dictyuchus* 521" a specific epithet, because he questioned the delimitation of species in *Dictyuchus*. Later that year, Johnson et al. (1951) concluded that "*Dictyuchus* 521" was probably a strain of the variable species, *D. pseudodictyon.*

Padgett and Seymour (1974) demonstrated that sporangial morphology was more complex when they discovered four sporangial types among their *Dictyuchus* isolates: (1) true-net type I, (2) true-net type II, (3) false-net, and (4) achlyoid (Fig. 1). In true-net type I, no space is evident between spore cysts or between cysts and the sporangial wall. In true-net type II, there is not the intersporal space characteristic of false-net sporangia, but space does occur between the mass of spore cysts and the sporangial wall. Padgett and Seymour (1974), citing Couch (1931), discussed the false-net isolates as being possibly divisible, depending on production of achlyoid sporangia. However, they observed variation sufficient to obviate interspecific taxonomic use of sporangial characters, and believed that sexual traits might prove more useful in species discrimination. Though questioning distinctions of species (as had Johnson, 1951), Padgett and Seymour (1974) thought that the dictyoid (be it true- or false-net), often deciduous sporangium could define the genus *Dictyuchus (sensu lato).*

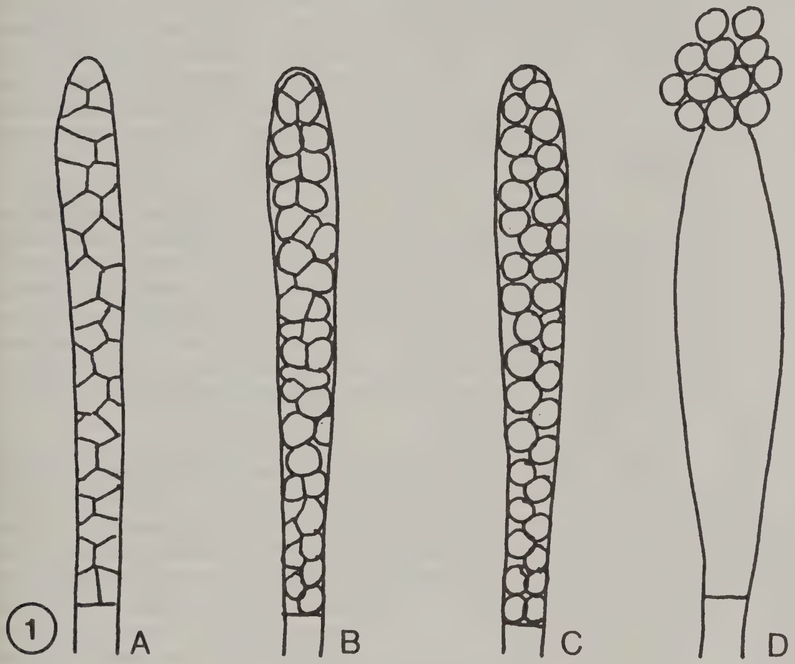

FIGURE 1. Sporangial types in *Dictyuchus* (after Padgett and Seymour, 1974). A. True-net Type I, with angular spore cysts and no intersporal space or space between spores and sporangial wall. B. True-net Type II, with angular spore cysts and no intersporal space, but with some space evident between spores and sporangial wall. C. False-net, with spore cysts more rounded and some intersporal space evident. D. Achlyoid, with spores released through sporangial apex, forming a ball-like cluster of spore cysts.

The intergeneric problem is not that of distinction of the true-net or *monosporus* component of *Dictyuchus* from other genera of the Saprolegniaceae, but resides in delimiting the false-net taxa as a group. Other, genera of the family such as *Brevilegnia* (see Salvin, 1942; Langsam, 1987), *Thraustotheca* (see Blackwell and Powell, 1993), *Aphanodictyon* (Huneycutt, 1948), *Protoachlya* (Coker, 1923), and *Achlya* (see Couch, 1931) may form an apparent false-net sporangium, i.e., encysted spore walls may remain temporarily adherent, even after degeneration of the sporangial wall. Moreover, achlyoid development, not uncommon in false-net *Dictyuchus* species, is known in species assigned to *Brevilegnia* and *Thraustotheca*, in addition to *Achlya.*

The fundamental question is whether to retain a polymorphic concept of *Dictyuchus,* encompassing true- and false-net taxa (*sensu* Couch, 1931; Padgett and Seymour, 1974), understanding that isolates of both categories may exhibit achlyoid release; or, to limit the concept as in Leitgeb's (1868, 1869-70) application of the generic name to organisms with a dictyosporangium of the *monosporus* type, i.e., with a "true net." In a restrictive definition, centered around *D. monosporus* (and *D. anomalus*, if recognized), the problem becomes the disposition of the other (i.e., false-net) taxa. Couch (1931) and Padgett and Seymour (1974) discussed recognition of false-net taxa as a separate genus, but took no action. It is debatable whether or not false-net species of *Dictyuchus,* as a group, could be satisfactorily delimited as a genus in the Saprolegniaceae. Features, such as sporangial development, sporangial wall persistence, adherence of spore cysts, and mode of spore release, potentially intergrade between the false-net taxa of *Dictyuchus* and *Brevilegnia, Thraustotheca, Aphanodictyon,* some species of *Achlya,* and some true-net isolates of *Dictyuchus.*

The progression of sporangial types (Langsam, 1986; Blackwell and Powell, 1993) is relevant to taxonomic placement of species of the false-net group of *Dictyuchus.* If primary or first-formed sporangia are more important in determining relationship, one species of the false-net group, *D. achlyoides* (which usually forms achlyoid sporangia prior to forming false-net sporangia), should be transferred to another genus of the Saprolegniaceae, such as *Brevilegnia* or perhaps *Achlya.* If, however, later-developed (or dominant) sporangial type is more important, and three significant characters suggested (below) are considered, then the false-net or *pseudodictyon* species of *Dictyuchus,* including *D. achlyoides,* should remain associated with *Dictyuchus monosporus,* in a generic complex.

The first character is that, in both the true-and false-net groups of *Dictyuchus,* germination of primary zoospore cysts is typically within the sporangium, or within what constituted the former sporangium (i.e., the maintained sporangial outline). This is because (second character) the spore-cyst walls usually remain appressed to each other (whether it be in a true- or false-net manner). Weston (1919) believed that the "close union" of cyst walls was generically important. Thus (third character), the sporangium (or the adherent spore-cyst mass) tends to behave as a composite reproductive unit, most evident in isolates of *Dictyuchus* with deciduous sporangia. Primary spore-cyst germination may be "dictyuchoid" in which secondary zoospores escape the cyst chambers, or "aplanoid" in which direct germination into hyphae occurs (cf. Leitgeb, 1869-70, Plate 23, Fig. 8; Johnson, 1956, Plate 1, Figs. 2b,c).

In genera of similar appearance to *Dictyuchus*, such as *Brevilegnia*, *Thraustotheca*, *Calyptralegnia*, or some species of *Achlya*, none of the three features discussed above, which together provide a definition of *Dictyuchus*, is usually true. These three related characters result in a subtle yet significant difference of sporangial appearance and function (as a potential compound reproductive unit) in *Dictyuchus*, compared with similar genera. Our view of the spore-cyst net of *Dictyuchus*, as an essentially colonial structure, is not in conflict with Weston's (1919) "repeated zoospore emergence," since the latter constitutes regerminations following swarming, relocation, and encystment of the initial secondary zoospores--an effective elaboration on basic asexual reproduction in the genus.

In basing the concept of *Dictyuchus* on a persistent, quasi-communal, spore-cyst network, we have not emphasized another part of the traditional generic concept, i.e., the typical possession of but one oospore per oogonium (see for example Sparrow, 1960). In phenetic analysis of genera of the Saprolegniaceae (Powell and Blackwell, 1998), the number of oospores per oogonium was found to be relatively less significant in generic delimitation than a combination of asexual features; this was true in the case of

Dictyuchus as well as some other genera such as *Thraustotheca, Brevilegnia,* and *Couchia.* Hence, the generic recognition of *Dictyuchus* does not necessarily depend on the number of oospores per oogonium. If a *Dictyuchus* isolate with multiple oospores per oogonium were confirmed (e.g., similar to that described by Lindstedt, 1872, as *D. polysporus),* this isolate could still be accommodated within the generic limits of *Dictyuchus,* on the basis of asexual (sporangial) characteristics.

No saprolegniaceous genus other than *Dictyuchus* possesses a sporangium of the true-net type. The only other genus which possesses, as the usual occurrence, a persistent false-net sporangium is the keratinophilic *Aphanodictyon* Huneycutt (1948). *Aphanodictyon* placed morphologically closest to *Dictyuchus* in phenetic analyses of genera of the Saprolegniaceae (Powell and Blackwell, 1998), yet is phenetically distinct. *Dictyuchus* is separated from *Aphanodictyon* potentially by (1) the number of oospores per oogonium; (2) hyphal thickness; (3) sporangial shape, branching, and possible deciduous nature; (4) distinctiveness of spore-cyst papillation; and (5) non-keratinophilic habit. Insufficient grounds exist for merging *Dictyuchus* and *Aphanodictyon,* regardless of sporangial similarity.

Based on the combination of the usual or eventual nature of sporangial development (net-like), of spore cyst destiny (remaining associated during and past spore germination), and maintenance of the basic sporangial form (if not the sporangial wall), the *D. pseudodictyon* (false-net) group of species should for now remain within the loosely drawn confines of *Dictyuchus,* along with the true-net species (i.e., *D. monosporus*). We favor thus an umbrella-like concept of *Dictyuchus*, similar to that of Couch (1931) and Padgett and Seymour (1974), and continued recognition of *Dictyuchus* as a genus of the Saprolegniaceae. Corroboratively, our polythetic analysis of light microscopic characters in the Saprolegniaceae (Powell and Blackwell, 1998) indicated *Dictyuchus* (lumping true- and false-net species) to be a phenetically distinct genus. We recognize, however, that *Dictyuchus* is heterogeneous, and composed of species which are morphologically plastic. These species are difficult to delimit, and their relationships to one another are questionable. The intergrading variation observed between species, particularly between true- and false-net taxa (Johnson, 1951; Padgett and Seymour, 1974), mitigates against formal taxonomic categories such as subgenera, in the genus.

FURTHER STUDIES

Additional ultrastructural and cytochemical work, similar to Powell et al. (1985) and Powell and Blackwell (1995) on the K-body of the zoospore, could clarify relationships of species within the *D. pseudodictyon* group to *D. monosporus,* and of *Dictyuchus* to morphologically similar genera of the Saprolegniaceae, such as *Brevilegnia, Calyptralegnia, Thraustotheca, Aphanodictyon, Achlya,* and *Protoachlya.* Armbruster (1982) earlier established, in presporangial hyphae, that *Dictyuchus anomalous* and *D. pseudodictyon* were more similar to each other than to *Achlya debaryana* in nuclear orientations and certain organelle characteristics. Armbruster's findings, thus, lend modest support to continued recognition of *Dictyuchus* (*sensu lato).*

Molecular studies may also prove significant in understanding the systematics of *Dictyuchus*. Berg and Patterson (1986), in a limited survey of sterol biosynthesis in Oomycetes, found that D. *monosporus* could produce an unusual sterol mixture. Surveying other species of *Dictyuchus* for sterol content could yield meaningful systematic information. Suryanarayana and Thomas (1986) found (in members of the Saprolegniaceae examined) that asexual spore release, including particular modes of spore release, may be under calmodulin control; extension of this work could be instructive in understanding comparative spore release patterns. Work done at the molecular genetic level, similar to Daughterty et al. (1998), may provide the greatest insights into the taxonomy of *Dictyuchus,* both infragenerically and intergenerically. Daugherty et al. (1998) noted that their particular molecular evidence, in a limited survey of genera, indicated that *Dictyuchus* (based on *D. "sterile"*) "appears to have evolved along a separate evolutionary lineage" within the Saprolegniaceae. Further correlative molecular and morphological analysis, extended to all taxa of *Dictyuchus* (especially alleged false-net species), and to additional genera of the Saprolegniaceae, will most clearly answer the question of maintenance, inclusiveness, or alteration of the concept of *Dictyuchus.*

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LITERATURE CITED

ARMBRUSTER, B.L. 1982. Sporangiogenesis in three genera of the Saprolegniaceae. I. Pre-sporangium hyphae to early primary spore stage. Mycologia 74: 433-459.

ARMBRUSTER, B.L. and T.W. JOHNSON, Jr. 1983. Comparison of cyst and sporangium wall widths in species of *Dictyuchus*, *Brevilegnia*, and *Achlya*. Can. J. Bot. 61: 545-550.

BENEKE, E.S. 1948. A new species of *Achlya* and of *Dictyuchus*. J. Elisha Mitchell Sci. Soc. 64: 261-265.

BERG, L.R. and G.W. PATTERSON. 1986. Phylogenetic implications of sterol biosynthesis in the Oomycetes. Exp. Mycol. 10: 175-183.

BLACKWELL, W.H. and M.J. POWELL. 1993. Taxonomic history of the Oomycete genus *Thraustotheca*. Mycotaxon 47: 183-192.

BONNER, J.T. 1952. Morphogenesis, an Essay on Development. Princeton University Press, Princeton, New Jersey.

BUSGEN, M. 1882. Die Entwicklung der Phycomycetensporangien. Jahrb. Wiss. Bot. 13: 253-285.

CHIOU, T.S. and H.S. CHANG. 1976. Aquatic Phycomycetes of Taiwan II. Bot. Bull. Acad. Sin. 17: 37-53.

COKER, W.C. 1923. The Saprolegniaceae with Notes on Other Water Molds. The University of North Carolina Press, Chapel Hill.

COKER, W.C. 1927. Other water molds from soil. J. Elisha Mitchell Sci. Soc. 42: 207-226.

COKER, W.C. and H.H. BRAXTON. 1926. New water molds from soil. J. Elisha Mitchell Sci. Soc. 42: 139-149.

COKER, W.C. and V.D. MATTHEWS. 1937. Family 1. Saprolegniaceae. North American Flora 2(1): 17-58.

CORNU, M.M. 1872. Monographie des Saprolegniees, etude physiologique et systematique. Ann. Sci. Nat. Bot. (ser. 5) 15: 1-198.

COUCH, J.N. 1926. Heterothallism in *Dictyuchus*, a genus of the water moulds. Ann. Bot. London 40: 849-881.

COUCH, J.N. 1931. Observations on some species of water molds connecting *Achlya* and *Dictyuchus*. J. Elisha Mitchell Sci. Soc. 46: 225-230.

DAUGHERTY, J., T.M. EVANS, T. SKILLOM, L.E. WATSON, and N.P. MONEY. 1998. Evolution of spore release mechanisms in the Saprolegniaceae (Oomycetes): Evidence from a phylogenetic analysis of internal transcribed spacer sequences. Fungal Genet. Biol. 24: 354-363.

DE BARY, A. 1888. Species der Saprolegnieen. Bot. Zeit. 46: 597-610, 613-621, 629-636, 645-653. (edited by H.G. Solms-Laubach)

DICK, M.W. 1973. Saprolegniales. Pgs. 113-144 In: The Fungi, An Advanced Treatise. Ainsworth, G.C., F.K. Sparrow, and A.S. Sussman, eds. Academic Press, New York and London.

EL-NAGDY, M.A. and S.I.I. ABDEL-HAFEZ. 1990. Occurrence of zoosporic and terrestrial fungi in some ponds of Kharga Oases, Egypt. J. Basic Microbiol. 30: 233-240.

FISCHER, A. 1892. Saprolegninae. In: Rabenhorst's Kryptogamenflora 1(4): 310-383.

FITZPATRICK, H.M. 1930. The Lower Fungi: Phycomycetes. McGraw-Hill, New York.

HARVEY, J.V. 1930. A taxonomic and morphological study of some members of the Saprolegniaceae. J. Elisha Mitchell Sci. Soc. 45: 319-332.

HOWARD, K.L., R. SEYMOUR, and T.W. JOHNSON, Jr. 1970. Aquatic fungi of Iceland: Saprolegniaceae. J. Elisha Mitchell Sci. Soc. 86: 63-79.

HUMPHREY, J.E. 1893. The Saprolegniaceae of the United States with notes on other species. Trans. Amer. Phil. Soc. (N.S.) 17: 63-148.

HUNEYCUTT, M.B. 1948. Keratinophilic Phycomycetes I. A new genus of the Saprolegniaceae. J. Elisha Mitchell Sci. Soc. 64: 277-285.

ICBN. 1994. International Code of Botanical Nomenclature. Adopted by the Fifteenth International Botanical Congress, Yokohama, Japan (Tokyo Code). Koeltz Scientific Books, Konigstein, Germany.

ING. 1979. Index Nominum Genericorum, Vol. 1. Farr, E.R., J.A. Leussink, and F.A. Stafleu (eds.). Reg. Veg. Vol. 100.

JOHNSON, T.W., Jr. 1951. An isolate of *Dictyuchus* connecting the false-net and true-net species. Mycologia 43: 365-372.

JOHNSON, T.W., Jr. 1956. The Genus *Achlya*: Morphology and Taxonomy. University of Michigan Press, Ann Arbor.

JOHNSON, T.W., Jr., A.W. ZIEGLER, and B. LINTHICUM. 1951. A note on *Dictyuchus pseudodictyon.* Mycologia 43: 728-729.

KHULBE, R.D. and S.C. SATI. 1983. A new species of *Dictyuchus* and key to the other species. Biblioth. Mycologica 91: 609-617.

KLICH, M.A. and L.H. TIFFANY. 1985. Distribution and seasonal occurrence of aquatic Saprolegniaceae in northwest Iowa. Mycologia 77: 373-380.

LANGSAM, D.M. 1986. *Achlya bispora*: A taxonomic reassessment of *Brevilegnia bispora*. Mycologia 78: 600-604.

LANGSAM, D.M. 1987. Notes on the genus *Brevilegnia*: Two excluded taxa. Mycologia 79: 323-324.

LEITGEB, H. 1868. Zwei neue Saprolegnieen. Bot. Zeit. 26: 502-503.

LEITGEB, H. 1869-70. Neue Saprolegnieen. Jahrb. fur Wiss. Bot. 7: 357-389.

LINDSTEDT, K. 1872. Synopsis der Saprolegniaceen, und Beobachtungen uber einige Arten. Friedlander & Sohn, Berlin.

MINDEN, M. Von. 1915. Familie: Saprolegniaceae. Kryptogamenflora der Mark Brandenburg 5: 506-574.

NAGAI, M. 1931. Studies on the Japanese Saprolegniaceae. J. Fac. Agr. Hokkaido Univ., Sapporo, 32: 1-43.

PADGETT, D.E. and R.L. SEYMOUR. 1974. Variability of zoospore discharge in species of the genus *Dictyuchus*. Mycologia 66: 615-627.

POWELL, M.J. and W.H. BLACKWELL. 1995. Searching for homologous ultrastructural characters in zoosporic fungi. Can. J. Bot. 73(Suppl. 1): S693-S700.

POWELL, M.J. and W.H. BLACKWELL. 1998. Phenetic analysis of genera of the Saprolegniaceae (Oomycetes). Mycotaxon 68: 505-516.

POWELL, M.J., L.P. LEHNEN, Jr., and R.N. BORTNICK. 1985. Microbody-like organelles as taxonomic markers among Oomycetes. Biosystems 18: 321-334.

RAI, J.N. and J.K. MISRA. 1978. A new species of *Dictyuchus* from alkaline ponds of India. Current Science 47(5): 171-172.

SALVIN, S.B. 1942. Variations of specific and varietal character induced in an isolate of *Brevilegnia*. Mycologia 34: 38-51.

SPARROW, F.K., Jr. 1960. Aquatic Phycomycetes, 2nd. rev. ed. Univ. Michigan Press, Ann Arbor.

SURYANARAYANA, K. and D.D.S. THOMAS. 1986. Asexual spore release from saprolegniaceous water molds: Involvement of calmodulin. J. Gen. Microbiol. 132: 593-598.

TOMA, N. 1970. *Dictyuchus missouriensis* Couch, var. *moruzii* nov. var. Rev. Roum. Biol., Bot. 15: 253-258.

WESTON, W.H. 1919. Repeated zoospore emergence in *Dictyuchus*. Bot. Gaz. 68: 287-296.

WOLF, F.T. 1944. The Aquatic Oomycetes of Wisconsin. Part One. Univ. Wisconsin Press, Madison.

ZIEGLER, A.W. 1958. The Saprolegniaceae of Florida. Mycologia 50: 693-696.

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TRICHOLOMA EUCALYPTICUM, A NEW RECORD TO EUROPE

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ABSTRACT

Tricholoma eucalypticum A. Pearson is an introduced australian species in Spain. We describe and discuss it from Spanish material. This is the first record for Europe .

RESUMEN

Tricholoma eucalypticum A. Pearson es una especie introducida procedente de Australia. Describimos y discutimos esta especie a partir del material recolectado en España. Se trata de la primera mención para Europa.

KEYWORDS

Basidiomycotina, *Agaricales*, *Tricholomataceae*, *Tricholoma*, *Tricholoma eucalypticum*, eucalyptus plantations, taxonomy, chorology.

INTRODUCTION

Some of the most culturing forest trees around the world belong to genera *Eucalyptus* L'Hér. There are large extentions with eucalyptus plantations out of their natural area, Australia, Tasmania, New Guinea and Timor, as it happens in Brazil, Argentina, South Africa, India and New Zealand. West iberian plantations stand out in Europe, where the most culturated species is *Eucalyptus globulus* Labill. (GOES, 1985; PEREZ MOREIRA, 1992).

These allochtonous forest systems are used by many fungi for extending their natural distribution. So, there are many references about Australasian species associated with these plantations (SANKARAN & al., 1995).

A new species for Europe is *Tricholoma eucalypticum* A. Pearson, a native taxon from Australia. We describe and discuss this species from Spanish collections.

MATERIAL AND METHODS

The methods used have been the usual for these kind of studies on Agaricales. Macroscopic characters and original drawings were taken from fresh material; microscopic ones from dry specimens, which were drawn by the aid of a camera lucida.

Common indices have been used such as IS (Index of Slenderness: $IS=l^2/d.D$; l=lenght of stem, D=diameter of cap, d=diameter of stem), L (number of entire lamellae), l (number of lamellulae between each pair of lamellae), E (quocient of lenght and width of the spores), Q (mean value of E in all collections studied) and n (number of measured spores).

The material was recorded and deposited at the Herbarium LOU-Fungi.

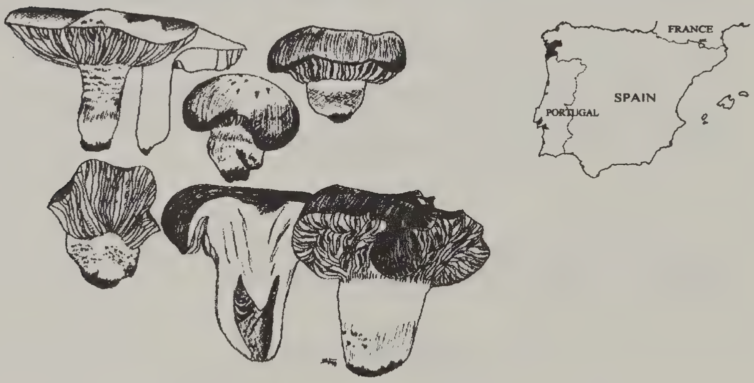

Fig. 1. On the left: Original drawings of *Tricholoma eucalypticum*, taken from fresh material (LOU-Fungi 9842 and LOU-Fungi 9850); on the right in black: Localization of studied area on N.W. Iberian Peninsula.

DESCRIPTION

Tricholoma eucalypticum A. Pearson, *Trans. Brit. Mycol. Soc.* 33: 294 (1951)

=*Tricholoma coartatum* Cleland, non Cooke & Massee, in *Toadtools and Mushrooms of South Australia*, I: 63 (1934)

Pileus 2-10 cm broad, first convex with incurved margin, later flattened or with an upturned and lobate margin in old specimens, pink-brownish colours darker at center, with radial fibrils or cracked into small scales in dry weather; smooth surface, dry or slightly gelatinous. Lamellae adnate emarginated to subdecurrent, crowded, L=75-130, broad and thick, first straight and white, soon wavy and pink-brown spotted, with lilaceous colours in dry material, lamellulae abundant, in many different sizes, l=1-3; edge smooth, entire to ragged with the age. Stipe 1-7 x 1-5 cm , cylindrical to clavate with truncate base, solid, white in upper 1/3, pink-brownish to base, smooth surface broken into small light brown scales when dry. Flesh white and dense in cap, fibrillous in stem, turn to brown with the age. Smell sweet like green waltnuts when young, unpleasant and sometimes foetid in old fruitbodies. Taste weakly bitter, like green waltnuts when young. Spore print white. IS= (0.2)0.3-1.3(1.4)

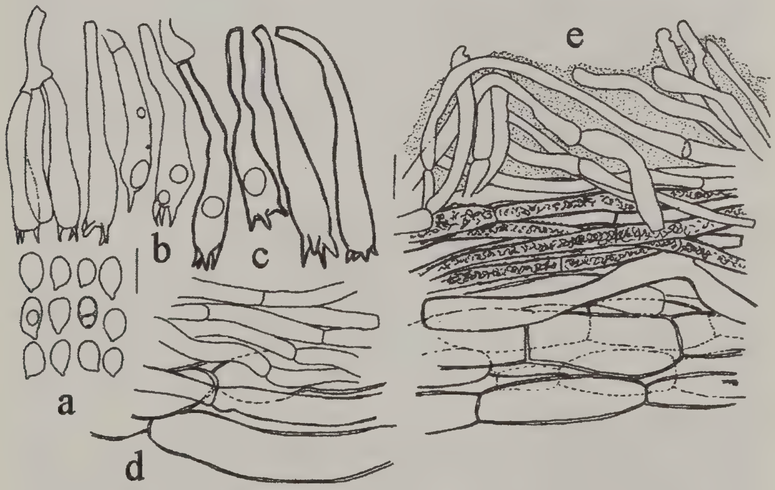

Fig. 2. *Tricholoma eucalypticum*, microscopical drawings: a) spores, b) basidia, c) brown thick-walled basidia, d) hyphal trama, e) radial section of pileipellis. Scale bar: 8 μm.

Spores broadly pip-shape to ovoid, slightly adaxial flattened, hyaline and inamyloid, (4.5)5-7.2(8) x 3.5-5(5.5) μm, mean 6 x 4.1 μm, E=1.2-1.8, Q= 1,5, n= 318, with large and slightly lateral hilar appendage, 1- or 2-

guttulated. Basidia cylindrical to narrowly clavate, 24-46 x 5.5-9 µm, hyaline or sometimes with refringent contens, thin-walled, 4-spored, sometimes 2- or 1-spored, sterigmata large, up to 4 µm long. Brown basidia with thicker walls, up to 1 µm, appear associated with pink-brown spotting process. Cheilocystidia and pleurocystidia absent. Hyphal trama with cylindrical to inflated hyphae, 4-24 µm broad, slightly thick-walled, without clamp-connections. Pileipellis as a thin ixocutis, with cylindrical hyphal ends, 3-6 µm broad, with refringent contents and strong incrusted walled hyphae.

COLLECTIONS STUDIED

SPAIN: PONTEVEDRA: Moaña, Domaio, way to Xaxán, 29TNG2683, 27-XII-1997, Leg: M.Lago & E.Luis, LOU-Fungi 9846; Nigrán, Monteferro, 29TNG1367, 22-XI-1998, Leg: M.Blach-Leyenda & C.Pascual, LOU-Fungi 9842; Pontevedra, A Xunqueira, 29TNG3098, 23-XI-1995, Leg: M.Lago, LOU-Fungi 8310; idem, 24-X-1996, Leg: M.Castro & M.Lago, LOU-Fungi 9847; idem, 5-I-1997, Leg: M.Lago & E.Luis, LOU-Fungi 9848; idem, 2-VI-1997, Leg: M.Lago, LOU-Fungi 9849; idem, 21-XI-1998, Leg: M.Lago & E.Luis, LOU-Fungi 9850; idem, 15-XII-1998, Leg: M.Lago, LOU-Fungi 9851; Vilaboa, Paredes, As Salinas, 29TNG3089, 19-XII-1998, Leg: M.Fernández-Díaz & C.López, LOU-Fungi 9845.

CHOROLOGY AND ECOLOGY

This *Tricholoma* was always collected under *Eucalyptus globulus*, on sandy soils, solitary or in groups, often hardly emerging from ground. We have found our collections from October to June in coastal land of N.W. Spain (see Fig. 1). The best fruiting season seems to be early winter in our area.

Tricholoma eucalypticum A. Pearson is an allochtonous mycorrhizal fungi in Europe, native from Australia where it grows under many eucalyptus species (BOUGHER & SYME, 1998: 216). It was mentioned out of its natural area in Cape Region, South Africa, under *Eucalyptus* sp., where it was described for the first time (SANKARAN & al., 1995: 256; PEARSON, 1951: 294).

DISCUSSION

The close European species belong to section *Albobrunnea* Konrad & Maubl., stirp *Pessundatum* (BON, 1991: 82-84; RIVA, 1988: 97). We stand out *Tricholoma ustale* (Fr.: Fr.) P.Kumm., *T. populinum* J.E.Lange, *T. stans* (Fr.) Sacc. and *T. pessundatum* (Fr.) Quél. These species have brown or brown-pinkish fruitbodies, slightly gelatinous caps, white or white-yellow gills, soon brown spotted from edge to inside, weak or strong farinaceous smell and bitter or sweet taste. All of them have a quite similar microscopical characters which are not suitable to differentiate each one. Nevertheless, they are well differentiated by ecological and macroscopical characters. *Tricholoma ustale* has slender fruitbodies, yellow-brown cap and stem, white-yellow gills, bitter taste, a calcicolous habitat and it grows under frondose trees (BON, 1991: 82; RIVA, 1988: 369-371; BREITENBACH & KRÄNZLIN, 1991: 342). *Tricholoma populinum* has stronger fruitbodies, with nut-brown or brown-pinkish cap, farinaceus smell and it grows only under *Populus* (BON, 1991: 83; RIVA, 1988: 377-381; BREITENBACH & KRÄNZLIN, 1991: 334). *Tricholoma stans* is a quite small species, brown-pinkish cap with radial fibrils, slender stem and it is a coniferous mycorrhizal fungi (BON, 1991: 82; RIVA, 1988: 373-376; BREITENBACH & KRÄNZLIN, 1991: 338). *Tricholoma pessundatum* grows only under coniferous trees, but it has a very fleshly fruitbodies with a very viscid cap and a strong farinaceous smell (BON, 1991: 83; RIVA, 1988: 359-364).

Tricholoma eucalypticum is well differentiated from these species by its deep pink or light pink-brownish fruitbodies, often robust and flattened, irregular shaped with slightly gelatinous cap and by its habitat, always growing under eucalyptus plantations (PEARSON, 1951: 294; BOUGER & SYME, 1998: 216).

However, our material has some microscopical differences. Spore range, (4.5)5-7.2(8) x 3.5-5(5.5)µm, is larger than Pearson´s original description, 4-5.5 x 3.5-4 µm (PEARSON, 1951: 294) and slightly larger than Bougher´s description, 5-6.5 x 3.5-4.5(5) µm (BOUGER & SYME, 1998: 216). There are no references about brown thick-walled basidia associated with the gill spots that we have observed.

There are no many references related to taste and smell. Only "*odor farinaceus*" and "*Sapor mitis sed tandem nauseosus*" appear in original description (PEARSON, 1951: 294). We have observed a characteristic sweet odour and taste like green waltnuts in young specimens.

Once all these differences are considered, we prefer to suggest that our collections belong to *Tricholoma eucalypticum*. Until further studies are undertaken, the differences that we have observed are not relevant for considering a new form or variety to this species.

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LITERATURE CITED

BON M. 1991. Les Tricholomes et ressemblants. Tricholomataceae (Fayod) Heim (1ére partie: Tricholomoideae-Leucopaxilloideae). *Doc. Mycol.* 21(84): 1-89.

BOUGHER N. L. & SYME K. 1998. *Fungi of Southern Australia*. CSIRO Australia.

BREITENBACH J. & KRÄNZLIN F. 1991. *Champignons de Suisse. Tome 3. Bolets et champignons à lames, 1ère partie: Strobilomycetaceate et Boletaceae, Paxilaceae, Tricholomataceae, Polyporaceae (lamellées).* Ed. Mykologia Lucerne.

GOES E. 1985. *Os eucaliptos (Identificaçao e Monografía de 121 especies existentes em Portugal.* Portucel.

PEARSON A.A. 1951. Cape agarics and boleti. *Trans. Brit. Mycol. Soc.* 33: 294.

PÉREZ MOREIRA, R. 1992. *Ecoloxía Forestal e ordenación do bosque.* Ed. do Castro.

RIVA A. 1988. *Tricholoma (Fr.) Staude*. Fungi Europaei 3. Libreria editrice Giovanna Biella. Saronno.

SANKARAN K.V.; SUTTON B.C. & MINTER D.W. 1995. A checklist of fungi recorded on Eucalyptus. *Mycological Papers* 170: 1-376.

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DISTORIMULA A NEW ASCOMYCETE GENUS FROM SONORA, MÉXICO

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INTRODUCTION

Following a search of wood decomposers in the state of Sonora, we propose herein a new ascomycete genus. All relevant information regarding the type locality has been published (San Martín et al., 1999).

RESULTS

Distorimula San Martín, Lavín & Esqueda, gen. nov.

TYPE: **Distorimula mexicana** San Martín, Lavín & Esqueda (HOLOTYPE).

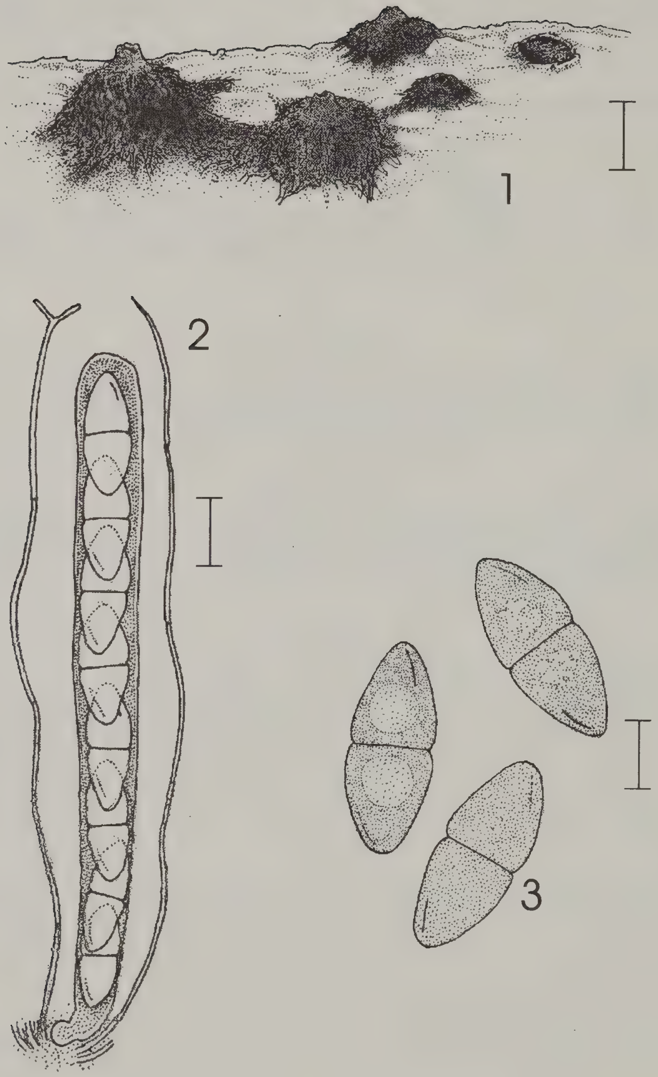
Stromata subglobosa vel hemisphaerica, uniperitheciata, solitaria vel bi-confluentes, immersa in parte, subiculo constans ex hyphis brunneis, septatis composito inductata. Perithecia subglobosa. Ostiola papillata, prominens. Paraphyses hyalinae, septatae, ramosae. Asci cylindrici, unitunicati, sine annulo apicale. Ascosporae ellipsoideae, bicellulares, brunneae, rima germinativa brevissima, origo in quoque extremo, in latis oppositis.

Stromata subglobose to hemispherical, uniperitheciate, solitary to bi-confluent, partially immersed in the substrate, covered by a subiculum of brown, septate hyphae. Perithecia subglobose. Ostioles prominently papillate. Paraphyses hyaline, septate, ramified. Asci cylindrical, unitunicate, without apical rings. Ascospores ellipsoid, bicellular, brown, with a short germ slit at the distal end of each cell in opposite sides.

Etymology Latin: *disto*: to be apart; *rima*: fissura; (dim. *rimula*, from *rimi* = fissure) the name alluding to the oppositely positioned germ slits, one at the distal end of each ascospore cell.

Distorimula mexicana San Martín, Lavín & Esqueda sp. nov. Figs. 1, 2, 3

Stromata subglobosa vel hemisphaerica, uniperitheciata, solitaria vel bi-confluentes, 0.9-1.2 mm diam., immersa in parte, subiculo constans byssioideo singulatim inductata, ex hyphis brunneis, septatis, 3.5-4 μm diam. Perithecia globosa, 0.7-0.8 mm diam. Ostiola



Figs. 1-3. **Distorimula mexicana**. 1. Stromata: Scale bar = 0.5 mm. 2. Eight-spored ascus with septate paraphyses: Scale bar = 15 µm. 3. Bicellular ascospores with distal germ slits: Scale bar = 6 µm.

papillata, prominentia, late aperta. Paraphyses hyalinae, septatae, ramosae 2-3 µm *lata. Asci cylindrici, unitunicati, octospori, in parte biseriatis sporis dispositio, stipite brevissimo, 139.5-169 µm longitudine tota x 9-11 µm crassi, partibus sporiferis 125.5-144 µm longitudine, sine annulo apicali aut valde reducto, inamyloideo. Ascosporae brunneolae vel brunneae, ellipsoideae, apicibus angustatis, bicellulares, cum septo in medio, (17-) 18-24 (-25) x (7.5-) 8-9 µm, area septata aliquantum constrictae, rima germinativa brevissima, 3-3.5 µm longa, origo quoque extremo, in latis oppositis.*

Stromata subglobose to hemispherical, uniperitheciate, solitary to confluent in twos, 0.9-1.2 mm diam, partially immersed, individually covered by a cottony subiculum consisting of brown, septate hyphae, 3.5-4 µm diam. Perithecia globose, 0.7-0.8 mm diam. Ostioles prominently papillate, wide open. Paraphyses hyaline, septate, ramified, 2-3 µm broad. Asci cylindrical, unitunicate, eight-spored with partly biseriate spore-arrangement, very short-stipitate, 139.5-169 µm total length x 9-11 µm broad, the spore-bearing part 125.5-144 µm, without an apical ring or one highly reduced and not bluing in Melzer´s iodine reagent. Ascospores light-brown to brown, ellipsoid with narrowly rounded ends, bicellular, the septum in the middle, (17-) 18-24 (-25) x (7.5-) 8-9 µm, somewhat constricted at the septum, with short germ slits 3-3.5 µm long, situated at the distal end of each cell on opposite sides.

SPECIMEN EXAMINED: México, Sonora state, San Javier municipality, km 151 Hermosillo-Yécora road, no date, on decorticated wood in low deciduous tropical forest, Esqueda 3693 (FSM, HOLOTYPE: CESUES, ISOTYPE).

NOTES: In the presence of subiculum and germ slits **Distorimula** resembles the xylariaceous genus **Rosellinia** , but differs in lacking ascal apical rings and the 1-septate ascospores. Like the amphisphaeriaceous genera **Cainia** and **Atrotorquata** the Mexican taxon has germ slits, but in **Cainia** they are continuous (Krug, 1977) and **Atrotorquata** has 5-7 discontinuous germ slits at the apex of the ascospore (Kohlmeyer and Kohlmeyer, 1993). Like **Entosordaria** (Clypeosphaeriaceae) **Distorimula** has distal germ slits, but in the genus there is one at each end of the equally two celled ascospores, while **Entosordaria** has unequal two-celled ascospores with radiating germ slits at the end of the larger cell (Eriksson, 1966). Finally, a subiculum is lacking in both **Cainia** and **Atrotorquata**.

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LITERATURE CITED

Eriksson, O. 1966. On **Anthostomella** Sacc., **Entosordaria** (Sacc.) Höhn. and some related genera (Pyrenomycetes). Svensk. Bot. Tidsk. 60: 315-324.

Kohlmeyer, J. and B. Volkmann-Kohlmeyer. **Atrotorquata** and **Loratospora**: new ascomycete genera on **Juncus roemerianus**. Systema Ascomycetum 12: 8-15 + Figs.

Krug, J. C. 1977. The genus **Cainia** and a new family, Cainiaceae. Sydowia 30: 122-133.

San Martín, F., P. Lavín, M. Esqueda and E. Pérez-Silva. 1999. Additions to the known Xylariaceae (Hymenoascomycetes, Xylariales) of Sonora, México. Mycotaxon 70: 77-82.

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RUSSULA OBTUSOPUNCTATA, A NEW SYNONYM FOR LACTARIUS VENEZUELANUS

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ABSTRACT

Lactarius venezuelanus is reported for the first time from Parana State, Brazil. Re-examination of the type of *Russula obtusopunctata* (=*R. heterochroa* Singer non Kuhner) shows that it is conspecific. It's taxonomic history and systematic position are discussed.

RESUME

Lactarius venezuelanus est signalé pour la première fois de l'Etat de Parana, au Brésil. Réexamination du type de *Russula obtusopunctata* (=*R. heterochroa* Singer non Kuhner) montre qu'il s'agit de la même espèce. L'histoire taxonomique et la position systématique sont discutées.

INTRODUCTION

A few years ago, Buyck received a number of Russulaceae collected by A. De Meijer in Parana State, Brazil. One of these specimens, determined in the field as being a *Russula*, possessed the main characteristics of *Russula obtusopunctata* Buyck, originally described from Manaus, Brazil under the name *Russula heterochroa* Singer non Kühner. However, the resemblances with the recently described *Lactarius epitheliosus* Buyck & Courtecuisse from French Guyana (in Courtecuisse & Buyck, 1991) and with *L. venezuelanus* Dennis (1970, our fig. 8) were equally striking. After re-examination of the types of these taxa, it is clear that *Russula obtusopunctata* is a misinterpreted *Lactarius* for which the correct name is *Lactarius venezuelanus*. It's distribution is here extended to Parana State, Brazil.

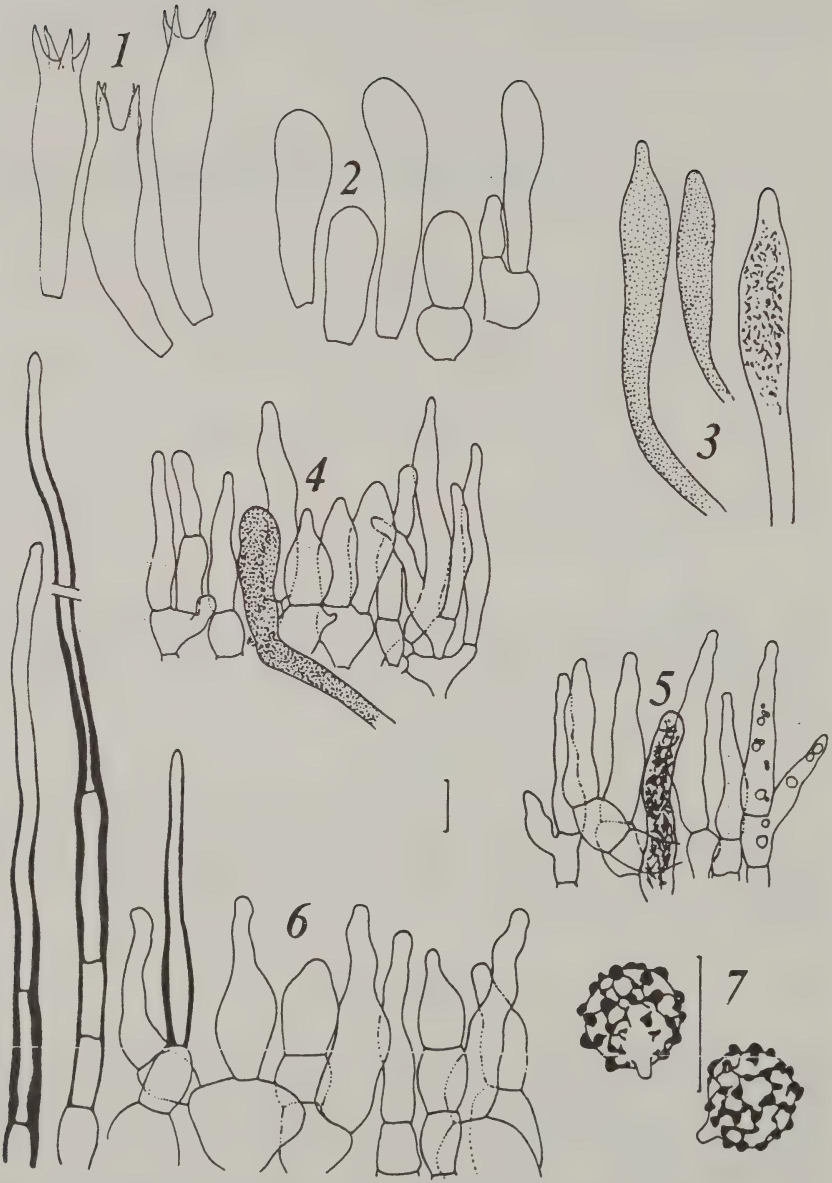

Fig. 1-7. *Lactarius venezuelanus* (AdM 1480). 1. Basidia. 2. Basidiola. 3. Pleuropseudocystidia. 4. Detail of lamella edge showing marginal cells and pseudocystidium. 5. Detail of stipitipellis. 6. Elements of suprapellis of pileus. 7. Spores observed in Melzer's reagent. Scale bar = 10 μm.

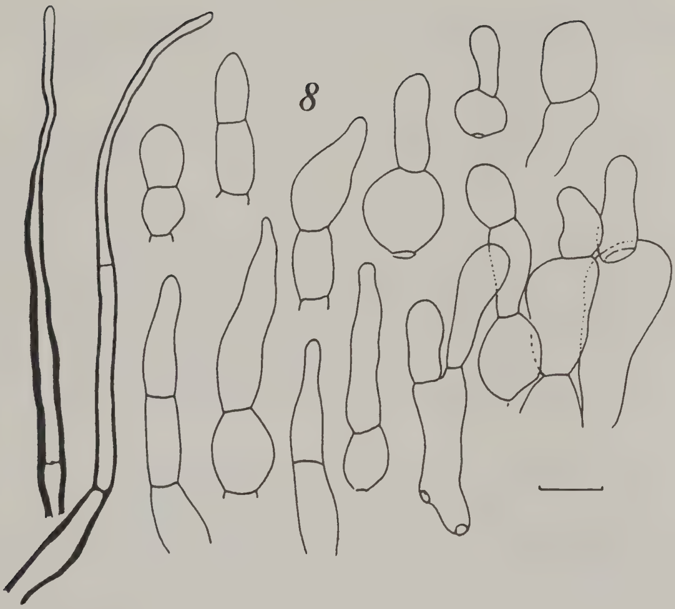

Fig. 8. *Lactarius venezuelanus* (holotype) : Elements of pileipellis. Scale bar = 10 µm.

MATERIALS AND METHODS

Macroscopic observations are from De Meijer. The microscopic features were examined and sketched by B. Buyck. All microscopic observations and measurements have been made in ammoniacal Congo red, after a short aqueous KOH pretreatment to improve tissue dissociation and matrix dissolution. Original drawings for all elements of the hymenium or pellis were made at a 2600 x magnification. All elements of the basidiome were controlled for the presence of ortho- or metachromatic contents or incrustations in cresyl blue as explained in Buyck (1989b).

Observations and measurements of spores were made in Melzer's reagent. Measurements are given according to Heinemann & Rammeloo (1985) and are based on 20 spores (n) per specimen for each species. The length/width ratio (Q) gives minimum, mean and maximum values. Original drawings of spores were made at a magnification of 6700 x using a monotubus with mirror. We refer the reader to Buyck (1991) for explanation of cystidial terminology.

DESCRIPTION

Lactarius venezuelanus Dennis, *Kew Bull. Add. ser.*3 :467. 1970.

syn.: - *Russula heterochroa* Singer, *Beih. Nov. Hedw.* 77: 273. 1983, non Kühner, *Bull. trimestriel Soc. mycol. France* 91: 389. 1975.
- *Russula obtusopunctata* Buyck, *Mycotaxon* 35: 56. 1989.

Basidioma lignicolous, often in pairs. *Pileus* 15-23 mm in diam., convex, depressed in the center, striate up to mid-radius, center and striations light brown (6D5), between striations light yellow (4A4), smooth, dry. *Lamellae* slightly decurrent, subdistant, lanceolate, not ventricose, 3 mm broad, not intervenose, with few rather long lamellulae, white ; edge concolorous. *Stipe* up to 12 mm long, 1.5-3 mm broad, slightly excentric, curved, tapering towards the base, greyish orange (5B5), yellowish towards apex, smooth, dry, solid , originating from an ill-developed, white basal mycelium (subiculum). *Veil* absent. Context white, unchanging, drying white. *Taste* not observed. *Odor* indistinct. *Latex* none. *Spore print* not obtained, obviously very pale, white on lamellae. *Exsiccatum* brittle, entirely reddish brown, transparant margin showing lamellae.

Spores subglobose to ellipsoid, 6.3-*6.97*-7.8(8.1) x 7.0-*7.87*-8.8(9.1) µm (Q=1.08-*1.13*-1.22) ; ornamentation composed of large, strongly amyloid, hemisphaerical to subsphaerical warts, up to 1 µm high, generally joined by very low, sometimes ramifying ridges forming a weakly amyloid network ; the whole spore surface verruculose - punctate ; plage generally very ill-differentiated with the verruculose-punctate ornamentation of the spore continuing to the base of the apiculus, rarely with a weakly amyloid spot. *Basidia* (40)45-56 x 10-12(13) µm, clavate, tetrasporic, rarely bi-or trisporic ; sterigmata very robust, (6)8-12 x 1.5-3 µm. *Macrocystidia* not differentiated. *Pseudocystidia* (=lactocystidia sensu Singer) very difficult to observe, dispersed, immerged or slightly emerging beyond the hymenium, fusiform, obtuse or ± appendiculate, slowly turning black in sulfovanillin. *Marginal cells* occupying the entire gill edge, versiform, containing a dispersed granulation (pigment ?). *Subhymenium* cellular. Lamellar trama composed of sphaerocytes and laticifers, these very numerous, 4-10 µm broad, slowly greying in sulfovanillin. *Pileipellis* orthochromatic in cresyl blue, all cells slightly incrusted (oil-immersion !), a discontinuous, ± pseudoparenchymatic layer, 3-5 cells deep, supporting a upper layer composed of irregularly inflated to sinuose, tapering cells and dispersed, often very long, multicellular, thick-walled 'hairs' that lay scattered on its surface ; laticifers numerous, but not striking, terminating in pseudocystidia ; true dermatocystidia absent. *Stipitipellis* discontinuous, composed of groups of extremities that resemble those of the pileipellis but smaller, typically two-celled, a shorter basal cell supporting a usually lageniformous, thin-walled terminal cell, without very long and thick-walled hairs ; towards the base composed of an almost continuous turf of shorter, often ± thick-walled cells ; laticifers and pseudocystidia as in pileus. *Basal mycelium* composed of thick-walled hyphae and laticifers. *Clamps* absent in all parts.

Specimens examined. BRAZIL: Parana : Morretes, Parque marumbi, Véu da Noiva, 200 m alt., 19 February 1990, A. De Meijer 1480 in herb. Buyck (PC) ; VENEZUELA: Estado Miranda, Los Guaybitos, 1300 m, 8 June 1958, Dennis 1004 (holotype, K).

Distribution : Brazil, Venezuela

Habitat. On decaying dicotyledonous twig or raw humus, under leguminous trees of campinarana vegetation and in dense ombrophilous forest.

DISCUSSION

Diagnostic characters are the (often ?) macroscopical absence of latex, the rarity of lamellulae, the curved and excentric stipe, the very well-developed pseudoparenchymatous subpellis and the large, almost hemisphaerical warts developing from the reticulum of the spores.

The typical pseudocystidia and the well-developed laticiferous system extending into the hymenophoral trama place this species in *Lactarius*, yet no latex is exuded. Further unusual characters for *Lactarius* are the rarity of lamellulae between the lamellae and the lamellar trama being almost entirely made up of sphaerocytes.

The above description is entirely based on the specimen from Parana State. The macroscopic features are consistent with those described by Dennis (l.c.) and later by Singer (in Singer et al., 1983) for *Russula heterochroa*. The microscopic features of the latter species have, however, never been described (see explanation below), although illustrations were published for the pileipellis (Buyck, 1989a: 58 as *R. nanella*) and spores (Buyck, 1990: 312 as *R. obtusopunctata*).

The taxonomic history of this species is yet another illustration of the fact that tropical mycology needs properly trained, local taxonomists instead of visiting herbarium-taxonomists. The nomenclatural changes (three times in nearly 10 years) are here briefly recapitulated : Singer (l.c.) described *Russula heterochroa* as a new species, unaware that this name had been occupied a few years earlier by Kühner. Buyck (1989a) proposed the new name *Russula obtusopunctata* for Singer's species and moved it to subsect. *Mimeticinae* Buyck on the basis of its microscopic features for which Buyck supplied a new description. One year later, in 1990, on annotating and preparing the return of the loans of the South American *Russula*-types, Buyck noticed that the metallic box marked '*R.heterochroa*' contained the involutum for *R.nanella* and vice versa. When trying to correct this error by comparing the microscopy of the type-specimens with the original descriptions of Singer, it became clear that the switch of specimens had been made by Singer himself, who had described the microscopic features of *R.nanella* twice : once for *R.nanella* and a second time erroneously for *R.heterochroa*. The microscopic features of the type for *R.heterochroa* had remained undescribed. As a result, Buyck (1989a) had redescribed the microscopy of *R.nanella*, and it is *R. nanella*, not *R.heterochroa* that belongs in *Mimeticinae*. The switch also explains why Singer had found the very different microscopic features of both types "allthough very similar, not quite identical". Buyck (1990) published a short communication to report on this switch and to correct his own paper on *Mimeticinae*.

In this correction, Buyck specified that the pileipellis of *R.obtusopunctata* matched exactly the description for the pileipellis of the pleurotoid *Lactarius panuoides* Singer. He illustrated spores and pileipellis, but did not supply a new description and the laticifers of the trama passed unnoticed. These laticifers are indeed easily looked over, perhaps because of the preponderance of large sphaerocytes in the context and hymenophoral trama. This type of context is typical for many tropical Russulaceae (Buyck, 1995, fig.3).

Buyck also studied a number of Russulaceae collected by Courtecuisse in French Guyana. In the resulting publication (Courtecuisse & Buyck, 1991), the new species *Lactarius epitheliosus* Buyck & Courtecuisse was published as type-species of the new subsection *Epitheliosi* Buyck & Courtecuisse, but the exact relation with the other infrageneric taxa of tropical *Lactarius* remained unclear at that time. *L. epitheliosus* has the same overall colours, possesses identical spores and also lacks exudation of latex when injured. It differs by the lack of ciliate thick-walled hairs in the cap and by the thikker and more spaced lamellae.

Another possibly closely related group of tropical *Lactarius* is section *Panuoidei* Singer (syn.: genus *Pleurogala* Redhead & Norvell), known from the neotropics and Japan (Singer, 1984). At least some of these species have a remarkably similar pileipellis, although with a less developed subpellis, but differ by the amyloid plage on the spores and of course by their surprising pleurotoid habit.

Recently, modern descriptions have become available for all tropical African *Lactarius* and a large number of new tropical *Lactarius* have been described from Africa (Verbeken, 1996), based for the larger part on the collections of one of us (Buyck). Taken into account the presence of dispersed, thick-walled and hair-shaped elements in the suprapellis, the well-developed underlying pseudoparenchymatous layer, the sphaerocytes in the lamellar trama, the absence of a veil, the absence of macrocystidia and the inamyloid suprahilar spot, only a limited number of infrageneric taxa from the newly proposed classification for the tropical African species (Verbeken, l.c.) present a possible solution for the neotropical *Lactarius venezuelanus*. Section *Chamaeleontini* Verbeken in subgenus *Lactariopsis* (Henn.) R. Heim corresponds exactly to the above criteria except for the absence of a well-developed pseudoparenchymatous subpellis. Of the three African species asigned to this section, *Lactarius chamaeleontinus* R. Heim corresponds also very well in the field, but differs principally by the more regularly intercalated lamellulae and the exudation of a white latex.

A well-developed pseudoparenchymatous layer covered by a dense trichoderm of thick-walled elements is found in several tropical sections of subgenus *Lactifluus* (Burl.) Hesler & A.H.Smith, but the thick-walled elements are of a somewhat different nature and there are often other microscopic differences (presence of pleuromacrocystidia, amyloidity of the suprahilar spot). Also the macroscopic aspect is usually quite different.

Lactarius venezuelanus probably has more or less close affinities with all of the above mentioned tropical species-groups and may even link sect. *Panuoidei* to the central-stiped *Lactarius* because of the small, curved and often excentric stipe. Until a well-documented microscopical re-examination of the other neotropical *Lactarius* becomes available, it is difficult to place this species, but I would place *L. venezuelanus* certainly close to the African species of sect. *Chamaeleontini*, subgenus *Lactariopsis*, perhaps in a (neotropical) section of its own. Future studies may also evaluate the importance of the presence or absence of the thick-walled hairs; which is the principal difference with *Epitheliosi*.

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LITERATURE CITED

Buyck, B. 1989a. Etudes microscopiques de Russules tropicales: *Mimeticinae* subsectio nov. *Mycotaxon* 35: 55--63.

Buyck, B. 1989b. Utilité taxonomique du bleu de crésyl dans le genre *Russula* Persoon. *Bull. trimestriel Soc. Mycol. France* 95: 1--6.

Buyck, B. 1990. *Russula obtusopunctata* : une rectification. *Mycotaxon* 39: 311--315.

Buyck, B. 1991. The study of microscopic features in *Russula*. 2. sterile cells of the hymenium. *Russulales News* 1: 62--85.

Buyck, B. 1995. Towards a global and integrated approach on the taxonomy of Russulales. Russulales News 3: 3-17.

Courtecuisse, R. & B. Buyck. 1991. Eléments pour un inventaire mycologique de l'Inselberg des environs du Saut Pararé (Arataye) et de l'Inselberg des Nouragues (Guyane Française). Mycol. Helv. 4 : 209-225.

Heinemann, P. & J. Rammeloo. 1985. De la mesure des spores et de son expression. *Agarica* 6(12): 366--380.

Singer, R. 1984. Tropical Russulaceae II. *Lactarius* section *Panuoidei*. *Nov. Hedw.* 40: 435-452.

Singer, R., I. Araujo & M.H.Ivory. 1983. The Ectotrophically Mycorrhizal Fungi of the Neotropical Lowlands, Especially Central Amazonia. *Beih. Nova Hedw.* 77: 1-352.

Verbeken, A. 1996. Biodiversity of the genus *Lactarius* Pers. in tropical Africa: 1-342, 269 Pl., 29 distr. maps. Doctoral thesis. Universiteit Gent, Belgium (unpubl.).

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VALIDATION OF RUSSULA DENNISII

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ABSTRACT

Russula dennisii nom inval. was considered to be synonymous with *Lactarius venezuelanus*. Examination of the types of both taxa revealed two very different species, belonging indeed to different genera. *Russula dennisii* is here validated and illustrated.

RESUME

Russula dennisii nom inval. a toujours été considéré comme étant un synonyme de *Lactarius venezuelanus.* Une révision des deux types a révélé deux espèces très différentes, appartenant effectivement à deux genres différents. *Russula dennisii* est donc validé et décrit.

INTRODUCTION

At the occasion of a revision of all putative members of *Russula* section *Archaeinae* for a symposium in commemoration of Prof. Heinemann (Buyck, 1998), *Russula dennisii* was provisionally included in my list of species excludendae on the basis of the present views of Singer (1975b, 1986, see below), Singer et al. (1983) and Pegler & Fiard (1983).

Russula dennisii is based on a collection made by Dennis and was illustrated in the Fungus flora of Venezuela (Dennis, 1970). The name was first introduced as a « nomen ad int. » (Singer, 1952) because of a strong macroscopical resemblance to *Lactarius hygrophoroides* rather than to any other species of *Russula,* and was later indeed abandoned as Singer (1975b) considered it to be a synonym of *Lactarius venezuelanus* Dennis (= *Lactarius dennisii* Singer nom. nud. in Singer 1975a) notwithstanding the important differences in macroscopical habit of both species. Pegler & Fiard (1983) confirmed the views of Singer in their revision of *Lactarius* for the Lesser Antilles.

The striking differences between *Russula dennisii* and *Lactarius venezuelanus* are immediately evident when comparing the watercolours published by Dennis (1970) for both type-specimens. *R. dennisii* has the appearance of a robust and firm species with a short, darker stipe and widely spaced gills whereas *L. venezuelanus*, on the other hand, is a smaller, ± slender and reddish brown species with a paler stipe and closely arranged gills. The features and affinities of *Lactarius venezuelanus* have been discussed at lenght by Buyck & De Meijer (this issue) and the type (Dennis 1004, K) is not only macroscopically, but also microscopically very different from the type of *Russula dennisii* (Dennis 383, K). The latter, being indeed a *Russula*, is here validated and the microscopic features of the type were reexamined, and are here sketched and redescribed.

MATERIALS AND METHODS

Macroscopic observations are from Singer (1952). All microscopic observations and measurements have been made in ammoniacal Congo red, after a short aqueous KOH pretreatment to improve tissue dissociation and matrix dissolution. Original drawings for all elements of the hymenium or pellis were made at a 2600 x magnification. All elements of the basidiome were controlled for the presence of ortho- or metachromatic contents or incrustations in cresyl blue as explained in Buyck (1989).

Observations and measurements of spores were made in Melzer's reagent. Measurements are given according to Heinemann & Rammeloo (1985) and are based on 20 spores (n). Original drawings of spores were made at a magnification of 6700 x using a monotubus with mirror. We refer the reader to Buyck (1991) for explanation of cystidial terminology.

DESCRIPTION

Russula dennisii Singer ex Buyck, spec. nov. -- Fig. 1-6.

Pileus 62-64 mm diam., flavus pallide ochraceo-brunneus, glaber vel indistincte venatus, marginem versus laevis, leviter sulcatus in sicco. Lamellae adnatae vel decurrentes, distantes, crassae, 4.5-7 mm latae, lamellulis intermixtae, cremeae. Stipes 17-23 x 14-15 mm, cilindrato-ventricosus, basim versus attenuatus, glaber, siccus, ochraceo-fulvus, plenus, annulo destitutus. Caro alba, mitis, inodora. Latex nullus. Sporae in cumulo colore ignotae, lamellarum superficie albae.

Sporae ellipsoideae, (6.7)6.9-8.11-9.1 x 5.2-6.15-7.2(7.3) μm (Q=1.25-1.32-1.38), verrucis valde amyloideis obtusis vel hemisphaericis usque ad 1 μm altis interconnectis vel in cristis brevibus confluentibus ornatae ; macula suprahilaris inamyloidea. Basidia (41)46-67 x 7.5-9 μm, tetraspora, aciem versus interdum bispora ; sterigmata 4-6(8) x 1.5-2 μm, basidiis deformibus valde longiora. Macrocystidia ± numerosa, 60-100(149) x 6-8(10) μm, vix emergentia, subcilindrata vel subfusiformia, obtusa vel appendiculata, tenuitunicata, grisea in SV. Pseudocystidia nulla. Pileipellis orthochromatica, subpellis pseudoparenchyma, suprapellis discontinua, cellulis generaliter 20-30 x 4-7(11) μm irregulariter inflatis sinuosis interdum furcatis vel acicularibus usque ad 50 μm longis crassotunicatis dermatocystidiisque fusoideis clavatis (24)40-70 x (6)7-10 μm intermixtis efformata. Holotypus : Dennis 383 (K)

synonym : *Russula dennisii* Singer ad int., Kew Bull. 7: 296 (1952).

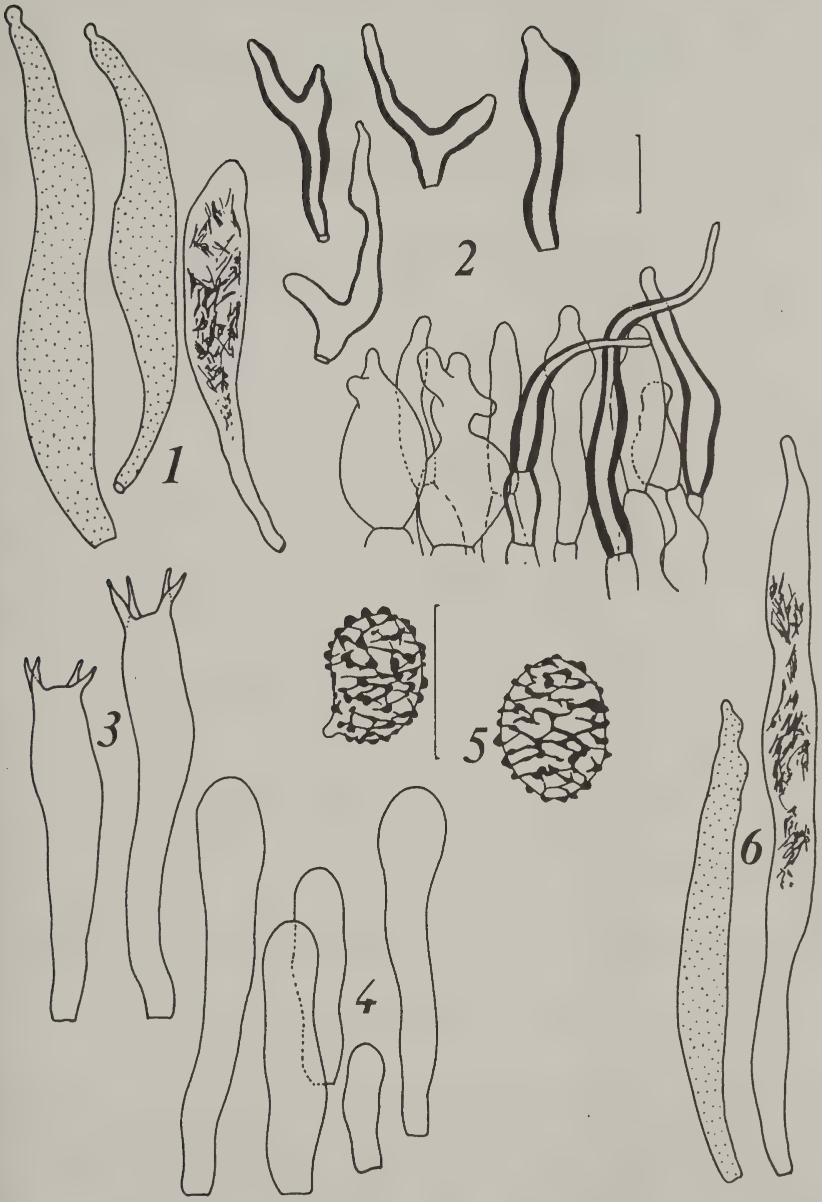

Fig. 1-6. *Russula dennisii* (R.W.G. Dennis 383, holotype K). 1. Pileocystidia. 2. Other elements of suprapellis of pileus. 3. Basidia. 4. Basidiola. 5. Spores observed in Melzer's reagent. 6. Pleurocystidia. Scale bars = 10 µm.

Pileus 62-64 mm diam., convex or applanate with depressed centre, with smooth acute margin, vaguely sulcate in dried condition, glabrous, with indistinct scattered veins, yellow with a slight ochre brown cast. ***Lamellae*** adnexed to decurrent, distant, thick, didymous, rather broad or medium broad, 4.5-7 mm, cream with a white bloom of spores. ***Stipe*** 17-23 x 14-15 mm, cylindrical, ventricose to obconical, tapering strongly from the apex to the base, which, however, is not acuminate, more or less longitudinally wrinkled in dried material, glabrous and dry, ochraceous fulvous, solid. Annulus absent. ***Context*** white, without latex, consistently mild, inodorous. ***Spore print*** not obtained.

Exsiccatum a fragmented basidiome suffering from attack by molds, such as *Penicillium,* much more fragile than Dennis' watercolour or the habit sketched in Pegler & Fiard would suggest; lamellae distant, thick; pileus thin, reddish-brown; stipe paler.

Spores ellipsoid, (6.7)6.9-*8.11*.9.1 x 5.2-*6.15*-7.2(7.3) µm (Q=1.25-*1.32*-1.38) ; ornamentation composed of strongly amyloid, obtuse to almost hemisphaerical warts of variable diam., up to 1 µm high, fused into short, sometimes ramifying ridges or interconnected by fine lines into a well-developed network ; plage smooth to slightly verruculose, inamyloid. ***Basidia*** (41)46-67 x 7.5-9 µm, narrowly clavate, tetrasporic, sometimes bisporic near the edge ; sterigmata 4-6(8) x 1.5-2 µm, sometimes ill-developped and then often less than four and much more voluminous and very long. ***Macrocystidia*** rather numerous, 60-100(149) x 6-8(10) µm, hardly emerging from the hymenium, narrowly fusiform to subcilindrical, rounded-obtuse to appendiculate, thin-walled ; contents cristalline, slowly greying in sulfovanillin. ***Pseudocystidia*** (=lactocystidia sensu Singer) not observed. ***Marginal cells*** hardly differentiated. ***Subhymenium*** composed of irregularly inflated cells and sphaerocytes. ***Lamellar trama*** mainly composed of large sphaerocytes. ***Pileipellis*** orthochromatic in cresyl blue, suprapellis a discontinuous layer of erect inflated extremities, arising from an underlying, locally well-developed pseudoparenchymatous layer ; terminal cells irregularly inflated to sinuose, sometimes forked or tapering and forming up to 50 µm long, thick-walled 'hairs' ; dermatocystidia dispersed (24)40-70 x (6)7-10 µm, fusiform to clavate, rounded to capitulate. ***Stipitipellis*** a dense layer of inflated cells that resemble those of the pileipellis, intermixed with numerous dermatocystidia. ***Clamps*** absent in all parts.

Examined material : TRINIDAD: beside the trail as it leaves Naranja for Tucuche, 27 nov. 1949, Dennis 383 (holotype, K)

Habitat : on bare soil in the lower montane forest at ca. 660 m

DISCUSSION

From Dennis' watercolours, it is immediately evident that *Russula dennisii* and *Lactarius venezuelanus* (syn.: *Lactarius dennisii* Singer 1975a nom. nud.) are macroscopically very different and it is difficult to understand that both Singer (1975b, 1986), Singer et al. (1983) and Pegler & Fiard (1983) considered these taxa to be conspecific, especially when also taking into account the important microscopical differences (see below). One of the consequences of this mis-interpretation is that, apart from the original description of *Lactarius venezuelanus* by Dennis, all descriptions published after 1975 combine the characters of both species and so do not reflect the actual features of *Lactarius venezuelanus* (see Buyck & De Meijer, this issue). Illustrations such as published by Pegler & Fiard (l.c.) apply to *R. dennisii* rather than to *L. venezuelanus*. Descriptions for *R. dennisii* appear not to have been published since the original publication of Singer (1952).

Russula dennisii lacks the typical pseudocystidia (lactocystidia sensu Singer) and the associated well-developed laticiferous system extending into the hymenophoral trama observed in *Lactarius venezuelanus*. On the other hand, there are numerous dermatocystidia on the surface of pileus and stipe (corresponding probably to the 'pleurocystidium' figured by Pegler & Fiard (1983, fig.1J), whereas *L. venezuelanus* lacks dermatocystidia. The extremities of the elements of the pellis in *R. dennisii* are also much more irregular in outline and often forked or developing irregular diverticules; their wall is much more frequently thickened and the aculeate 'hairs' are shorter than in *L. venezuelanus*. The spores of *R. dennisii* are more elliptical and the warts on the spores are less well-developed and tend to fuse in ridges, whereas they are larger and principally connected in *L. venezuelanus*.

When describing *Russula dennisii*, Singer had suggested a possible close relationship with *R. archaea* Heim. Both species share indeed the robust appearance although they possess a very thin pileus (see Buyck et al., 1998). However, *Archaeinae* differ by almost all of their microscopic features and they lack the well-developed pileipellis resulting in the smooth pileus surface of *R. dennisii*.

The exact systematic position of *R. dennisii* remains problematic. It corresponds well to the definition of *Delicoarchaeae* Singer (type species: *R. aucarum* Singer) but, here also, there is some confusion, since Singer (in Singer et al., 1983) cites the inamyloid suprahilar spot as one of the diagnostic characters of *Delicoarchaeae*. This, however, does not correspond to the reality since *R. aucarum* possesses a very strongly amyloid and thick suprahilar spot which is decurrent on the hilar appendage (Singer (l.c.) mentions a 'partly or entirely amyloid hilar appendix'). Placing *R. dennisii* in *Delicoarchaeae* seems, therefore, definitely excluded. I think that *R. dennisii* is probably part of one of those tropical 'mixed' groups, in which a number of *Russulae* share more with some *Lactarius* species than with any other *Russula*. Providing critical and well-illustrated descriptions of the neotropical *Lactarii* may, therefore, contribute to a better understanding of this species.

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LITERATURE CITED

Buyck, B. 1989 - Utilité taxonomique du bleu de crésyl dans le genre *Russula* Persoon. *Bull. trimestriel Soc. Mycol. France* 105: 1-6.

Buyck, B. 1991 - The study of microscopic features in *Russula*. 2. sterile cells of the hymenium. *Russulales News* 1: 62-85.

Buyck, B. 1998 - Une révision critique de la sect. *Archaeinae* (*Russula*, Russulales). *Belg. J. Bot.* 131(2) (in press)

Buyck, B. & A. De Meijer. 1999 - *Russula obtusopunctata* syn. nov. for *Lactarius venezuelanus*. *Mycotaxon* (this issue)

Buyck, B., G. Eyssartier & B. Duhem. 1998 - Contributions à un inventaire mycologique de Madagascar. I. *Bull. trimestriel Soc. Mycol. France* 114: 33-59.

Dennis, R. W. G. 1970. - Fungus flora of Venezuela and adjacent countries. *Kew Bull. Add. ser.* III, XXXV + 531 pp., 15 pl., 9 figs.

Heinemann, P. & J. Rammeloo. 1985. - De la mesure des spores et de son expression. *Agarica* 6(12): 366-380.

Pegler, D.N. & J. P. Fiard. 1983. - Taxonomy and ecology of *Lactarius* (Agaricales) in the Lesser Antilles. *Kew Bull.* 33: 600-628.

Singer, R. 1952 - Russulaceae of Trinidad and Venezuela. *Kew Bull.* 7: 295 - 301.

Singer, R. 1975a - Agaricales in Modern Taxonomy, 3ed., 912 pp., Vaduz, J. Cramer.

Singer, R. 1975b - Tropical Russulaceae. *Lactarius* section *Polysphaerophori* in the Gulf area. *Nov. Hedw.* 26: 897-901.

Singer, R. 1986. - The Agaricales in Modern Taxonomy. 4th revised ed. Koeltz Scientific Books. Koenigstein. 981 pp.

Singer, R., I. Araujo & M.H.Ivory. 1983. The Ectotrophically Mycorrhizal Fungi of the Neotropical Lowlands, Especially Central Amazonia. *Beih. Nova Hedw.* 77: 1-352.

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NEW DEMATIACEOUS HYPHOMYCETES FROM KENYAN RARE PLANTS

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As part of a programme investigating fungi associated with rare and endangered plant species in Kenya, collections of hyphomycetes from forest trees and lianes in western Kenya were analyzed. Six fungi have been identified as of particular interest and are described below.

MATERIALS AND METHODS

Collections of living and dead leaves and stems containing fungi were dried and preserved. Leaves were scanned for fungal colonies using a dissecting microscope and samples removed using the tip of a scalpel blade. Specimens were mounted on microscope slides in water or lactofuchsin and examined using bright-field, phase and Nomarski interference contrast optics (DIC). All measurements are from material in lactofuchsin. Drawings were made using a drawing tube attached to an Olympus BH-2 compound microscope, and photographs taken with an Olympus OM-2 camera and Agfapan 25 black-and-white print film.

Corynespora kenyensis Siboe, P.M. Kirk & P.F. Cannon, **sp. nov.** (Fig. 1)

Etymology: *kenyensis*, derived from the country of collection.

Ab *Corynespora cassiicola* differt: conidia 60–125 x 16–25 µm, obclavata vel obpyriformia, rostrata, crassiseptata.

Colonies effuse, brown, hairy. *Mycelium* immersed, inconspicuous. *Stroma* present but rudimentary, composed of a few cells of dark thick-walled

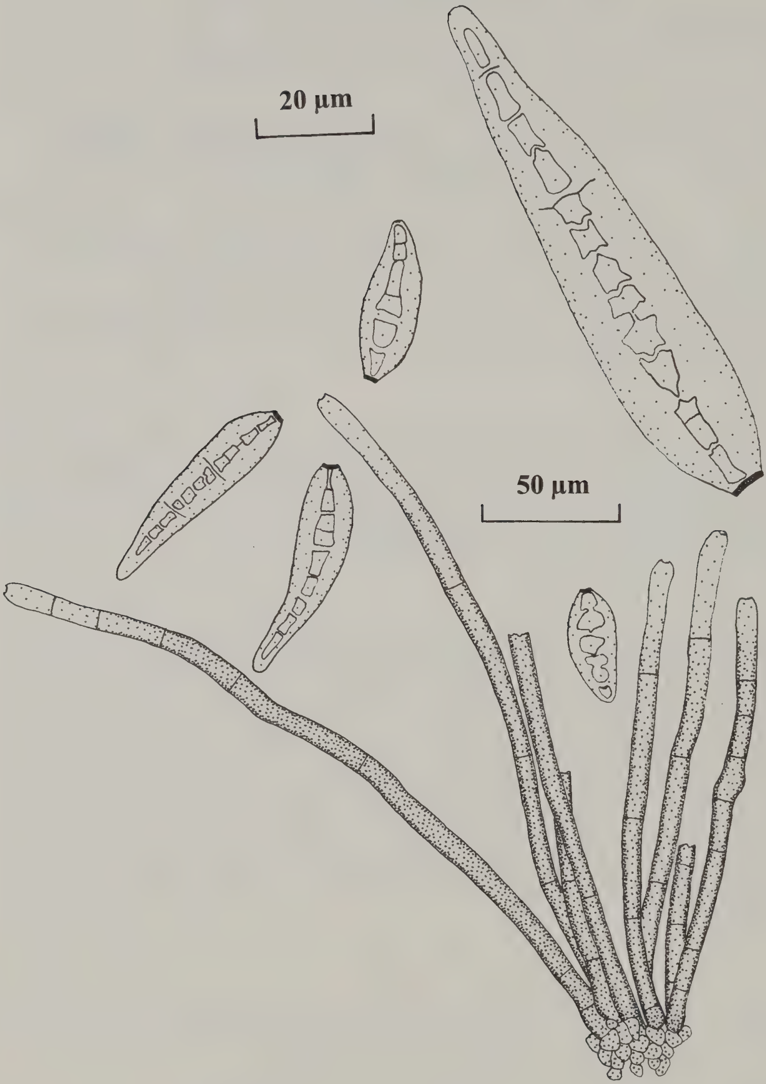

Fig. 1. *Corynespora kenyensis* (from holotype)

textura angularis on the substratum surface. *Conidiophores* 100–350 × 6–8 µm, macronematous, mononematous, formed in small groups usually of 4–8, flexuous, unbranched, olivaceous brown, smooth. *Conidiogenous cells* cylindrical, monotretic, integrated, terminal, proliferating percurrently, the scars not significantly thickened. *Conidia* 60–125 × 16–25 µm, solitary, dry, acrogenous, obclavate to obpyriform, the apex sometimes slightly rostrate, subhyaline to pale brown, with 8–15 distosepta with strongly constricted lumina and 3–4 eusepta visible as transverse lines, the base 4–6 µm diam., ± truncate, slightly more strongly pigmented, hardly protruding.

Typification: **Kenya**: Mumias, Kakamega Forest, Buyangu, track west of Salazar circuit towards river Isiukhu, on dead stems of *Sericostachys scandens*, 19 Jul. 1997, *P.F. Cannon* 74 (**IMI** 378522 - holotype).

Corynespora is a problematic genus, which has not recently been monographed. Many species are associated with leaf spots, apparently as necrotrophic pathogens, and have in the past been defined at least partially on the basis of host identity. Other species (especially *C. cassiicola* (Berk. & M.A. Curtis) C.T. Wei) are regarded as ubiquitous and plurivorous pathogens whilst some are saprobes for at least part of their life cycle. Table 1 provides basic characteristics of the currently accepted species.

Corynespora kenyensis can be distinguished easily from the *C. cassiicola* aggregate because it has conidia which are clearly obclavate to obpyriform, rather than cylindric-obpyriform. In addition, the distosepta are much thicker-walled than in *C. cassiicola*. The new species appears to be most similar to *C. siwalika* (Subram.) M.B. Ellis (Ellis, 1961). Both species have conidia which are heavily distoseptate with the lumina almost obscured and have usually 3–4 transverse oriented structures which may be primary septa. In *C. siwalika* conidia are rather more strongly rostrate, darker brown and have a more protuberant and pigmented basal scar. Other possible close relatives are *C. alstonei* Meenu *et al.* and *C. euphorbiacearum* Meenu *et al.* (Meenu *et al.*, 1997), which have usually longer and narrower conidia which are sometimes catenate. *Corynespora ligustri* Y.L. Guo (1984) appears to be similar, but judging from the illustration in that work the conidia are typically longer and much more irregular in form.

Dendryphion darwinii Siboe, P.M. Kirk & P.F. Cannon, **sp. nov.** (Fig. 2)

Etymology: *darwinii*, derived from the UK Government's Darwin Initiative, which funded this research.

Ab *Dendryphion comosum* differt: conidiophorae parce ramosae, conidia crassa, 12–52 x 6–12 µm, raro cheiroidea, verrucosa.

Table 1. *Major morphological features of currently known species of* Corynespora

Species	Conidiophores	Conidial production	Conidial morphology	Size (µm)	septation	Host/ substratum
acaciae	non-stromatic, mononematous	solitary	obclavate, smooth	16–30 × 6–8	1–5	*Acacia*
achradis	non-stromatic, mononematous	solitary	obclavate, rostrate, smooth	60–95 × 6–7	5–10	*Achras*
alstoniae	non-stromatic, mononematous	solitary (or catenate)	cylindrical to obclavate, smooth	48–154 × 8–21·5	2–15	*Alstonia*
alternarioides	non-stromatic, mononematous	solitary	obpyriform, smooth, muriform	32–45 × 11·5–13	6–8	*Acacia*
arctespora	non-stromatic, mononematous	solitary or catenate	cylindrical to obclavate, smooth	13–63 × 4–7	2–20	*Vaccinium*
bdellomorpha	non-stromatic, mononematous	solitary	obclavate, smooth	90–138 × 12–17	12–19	*Chusquea*
calicioidea	stromatic, synnematous	solitary	obclavate, smooth	50–170 × 10–15	6–21	plurivorous
camagueyensis	non-stromatic, synnematous	solitary or catenate	cylindrical, smooth	45–65 × 4–6	6–9	*Drypetes*
cassiicola	non-stromatic, mononematous	solitary or catenate	obclavate to cylindrical, smooth	40–220 × 9–22	4–20	plurivorous
catharanthicola	non-stromatic, mononematous	solitary or catenate	cylindrical, smooth	140–310 × 5·5–11	4–25	*Catharanthus*
cespitosa	stromatic, mononematous	solitary	obclavate, verrucose	55–85 × 18–29	3–9	*Betula*
citricola	stromatic, mononematous	solitary or catenate	± cylindrical to obclavate, smooth	48–150 × 4·5–8	4–18	*Citrus*
combreti	stromatic, mononematous	solitary	obclavate, ± rostrate, smooth	40–122 × 8–11	4–10	*Combretum*
cubensis	stromatic, mononematous	solitary or catenate	cylindrical to obclavate, ± smooth	40–80 × 8–11	6–15	*Coccothrinax*
elaeidicola	stromatic, mononematous	solitary or catenate	cylindrical to obclavate, smooth	43–65 × 4–7	3–7	*Areca*, *Elaeis*
eranthemi	non-stromatic, mononematous	solitary	obclavate, smooth	65–176 × 11–14	5–25	*Eranthemum*
euphorbiacearum	non-stromatic, mononematous	solitary or catenate	obclavate, smooth	59–235 × 11–22·5	5–18	*Euphorbiaceae*
garciniae	stromatic, mononematous	solitary	cylindrical to obclavate, smooth	29–60 × 4·5–7	5–7	*Garcinia*
gigaspora	stromatic, mononematous	solitary	obclavate, rostrate, smooth	100–270 × 19–28	9–52	dead wood
hansfordii	non-stromatic, mononematous	solitary	obclavate, ± rostrate, smooth	70–100 × 9–13	7–10	*Nauclea*
hemigraphidis	non-stromatic, mononematous	solitary	obclavate, smooth	72–218 × 12–15	5–25	*Hemigraphis*
heterospora	non-stromatic, mononematous	solitary	cylindrical to obclavate, smooth	75–170 × 6–20	6–12	*Manihot*
homaliicola	non-stromatic, mononematous	solitary	obclavate, cylindrical; smooth	110–220 × 11–22	13–28	*Homalium*
inornata	? non-stromatic, synnematous	solitary or catenate	obclavate, smooth	28–75 × 8–12	to 9	dead wood
kamatii	non-stromatic, synnematous	solitary	obclavate, smooth	60–70 × 10–13	7–12	*Vitis*

Table 1. (cont.)

Species	Conidiophores	Conidial production	Conidial morphology	Size (µm)	septation	Host/ substratum
lanneicola	stromatic, mononematous	solitary	obclavate, smooth	40–58 × 10–15	4–5	*Lannea*
leptoderridicola	stromatic, mononematous	solitary	obclavate, rostrate, smooth	70–120 × 14–17	6–16	*Leptoderris*
ligustri	non-stromatic, mononematous	solitary or catenate	obclavate to cylindrical, smooth	25–225 × 7·5–30	4–20	*Ligustrum*
longispora	stromatic, mononematous	solitary	± cylindrical, smooth	120–330 × 5·5–8	11–24	unknown
maculiformis	non-stromatic, mononematous	solitary or catenate	cylindrical to obclavate, smooth	20–86 × 5–10	2–8	*Prunus*, *Sorbus*
matuszakii	± stromatic, mononematous	solitary or catenate	cylindrical (to obclavate), smooth	56–260 × 10–12·5	2–10	? *Compositae*
merremiae	non-stromatic, mononematous	solitary or catenate	cylindrical to obclavate, smooth	37–150 × 6–12·5	4–22	*Merremia*
millettiae	non-stromatic, mononematous	solitary or catenate	obclavate, smooth	30–182 × 7·5–14	2–15	*Millettia*
mulanjeensis	non-stromatic, mononematous	solitary	obclavate to fusiform, smooth	56–71 × 10–12·5	5–8	dead wood
obclavata	non-stromatic, mononematous	solitary	obclavate, rostrate, smooth	32–62·5 × 9·5–11	4–6	*Serenoa*
occidentalis	non-stromatic, mononematous	solitary	ovoid to ellipsoidal, smooth	30–54 × 15–19	3–6	*Cordia*
olivacea	stromatic, mononematous	solitary	obclavate, faintly verrucose	50–105 × 12–19	5–14	*Tilia*, *Corylus*
polyphragmia	stromatic, mononematous	solitary or catenate	obclavate, smooth	110–280 × 14–17	10–25	*Camellia*
proliferata	non-stromatic, mononematous	solitary or catenate	obclavate, rostrate, smooth	30–300 × 9–12	3–17	*Fagus*, *Ulmus*
pruni	± stromatic, mononematous	solitary (or catenate)	obclavate, smooth	50–130 × 10–16	4–9	plurivorous
queenslandica	non-stromatic, mononematous	solitary	obclavate, smooth	72–114 × 8–10	6–9	*Acacia*
ruelliae	non-stromatic, mononematous	solitary	obclavate, smooth	60–150 × 12–15	5–16	*Ruellia*
salasiae	non-stromatic, mononematous	solitary	ellipsoidal, doliiform; smooth	17–20 × 8–12	0–2	*Gramineae*
siwalika	stromatic, mononematous	solitary	obclavate, ± rostrate, smooth	88–140 × 15–20	9–19	*Helicteres*
smithii	stromatic, mononematous	solitary to catenate	± cylindrical, smooth	70–410 × 12–19	7–45	plurivorous
trichiliae	stromatic, mononematous	solitary	obclavate, ± rostrate, smooth	53–74 × 9–11	4–6	*Trichilia*
vismiae	stromatic, mononematous	solitary or catenate	obclavate, rostrate, smooth	55–107 × 6–9	3–5	*Vismia*
viticis	non-stromatic, mononematous	solitary or catenate	cylindrical, smooth	80–383 × 6–9	many	*Vitex*
woodfordiana	non-stromatic, mononematous	solitary or catenate	obclavate, ± rostrate, smooth	40–170 × 9·5–17	4–14	*Woodfordia*
yerbae	stromatic, mononematous	solitary or catenate	± obclavate, smooth	72–170 × 16–18	8–19	*Ilex*

Colonies effuse, dark brown, hairy. *Mycelium* immersed. *Conidiophores* branched at the apex, forming a distinct stipe and head; stipe to 350 × 6 µm, 15- to 20-septate, straight or slightly flexuous, stout, erect, dark brown, smooth at the base with the upper part verruculose, formed singly or in small groups; branches pale and verruculose, with 1–4 primary branches formed singly or in pairs. *Conidiogenous cells* formed at the ends of branches, clavate, polytretic, integrated, proliferating sympodially, cicatrized, the scars dark. *Conidia* 12–52 × 6–12 µm, 1- to 7-septate, dry, probably catenate, acropleurogenous, simple or branched, almost cylindrical, rarely cheiroid, the apical cell rounded, pale brown, verrucose.

Typification: **Kenya**: Mumias, Kakamega Forest, 3 km S of Rondo's Retreat, forest on N side of Yala River, 00°12'N, 34°53'E, 1550 m alt., on dead stems of *Pseuderanthemum ludovicianum*, 16 Jul. 1997, *P.F. Cannon* 21 (**IMI** 376536 - holotype).

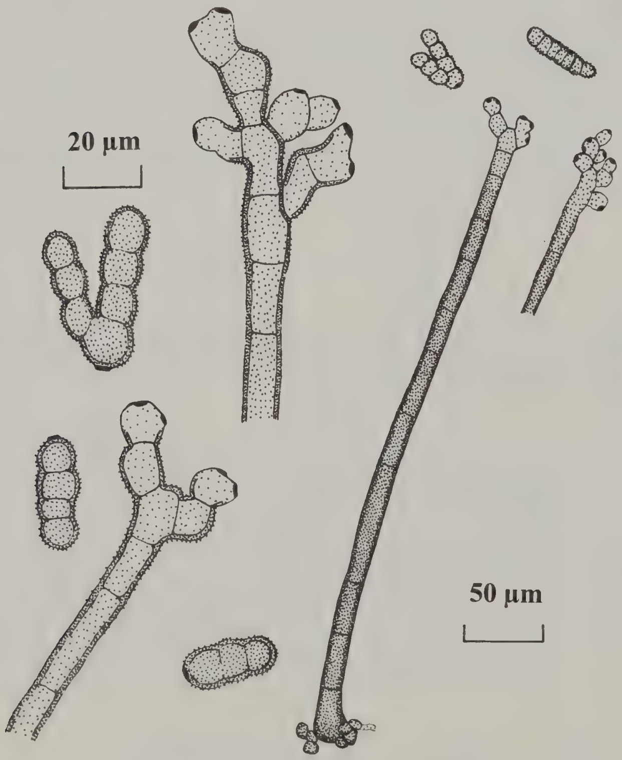

Fig. 2. *Dendryphion darwinii* (from holotype).

Dendryphion darwinii is saprobic and may well not be specialized to a single host genus, although some species (e.g. *D. penicillatum*: teleomorph *Pleospora papaveracea*) are considered to be host-restricted. It might possibly be a depauperate example of the ubiquitous *D. comosum*, but the differences in conidiophore structure seem reasonably constant.

Key to currently accepted species of Dendryphion

1 Conidia smooth 2
Conidia minutely verrucose or echinulate 3

2 Conidia 3-septate, concolorous .... **penicillatum**
Conidia 5- to 11-septate, with the ends cells paler .... **nanum**

3 Conidiophores sparsely branched, rarely with more than 3–4 short branches 4
Conidiophores usually many-branched 5

4 Conidia mostly forked, the branches 20–55 × 7–11 µm, mostly 3-septate but rarely elongate and up to 20-septate .... **digitatum**
Conidia usually simple, rarely cheiroid, 12–52 × 6–12 µm, 1- to 7-septate .... **darwinii**

5 Conidiophore branches relatively long, dichotomous; conidia 16–60 × 6–8 µm, to 15-septate, rarely branched .... **dichotomum**
Conidiophore branches short, convoluted; conidia 10–50 × 5–8 µm, 1- to 7-septate, frequently branched .... **comosum**

Helminthosporium kakamegense Siboe, P.M. Kirk & P.F. Cannon, **sp. nov.** (Fig. 3)

Etymology: *kakamegense*, derived from the type locality Kakamega Forest.

Ab *Helminthosporium dalbergiae* differt: conidia 30–90 × 8–10 µm, obclavata, rostrata, 4- ad 15-pseudoseptata.

Colonies effuse, dark, hairy. *Mycelium* largely immersed. *Stroma* absent. *Conidiophores* 250–550 × 8–12 µm, unbranched, solitary or often caespitose but not synnematous, mostly flexuous, dark brown, smooth, sometimes geniculate towards the tip. *Conidiogenous cells* polytretic, integrated, terminal and intercalary, determinate, cylindrical. *Conidia* 30–90 µm long, 8–10 µm wide in the broadest part, uniformly tapering to 2–4 µm wide at the apex, solitary, simple, straight or somewhat curved, obclavate, rostrate, subhyaline, smooth, with 4–15 pseudosepta.

Typification: **Kenya**: Mumias, Kakamega Forest, Buyangu, Mukangu trail, on dead attached twig of *Uvariopsis congensis*, 19 Jul. 1997, *P.F. Cannon* 65 (**IMI** 376518 - holotype).

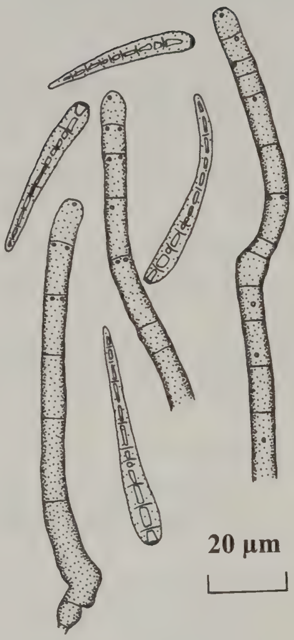

Fig. 3. *Helminthosporium kakamegense* (from holotype).

Helminthosporium was restricted to species with determinate conidiogenous cells by Shoemaker (1959) and Ellis (1961). They excluded species (including many important cereal pathogens) with sympodially proliferating conidiogenous cells, which are now referred to genera such as *Drechslera*, *Bipolaris* and *Exserohilum*. Table 2 includes data on conidial characteristics of species currently accepted in the genus.

Helminthosporium kakamegense is unusual in the relatively close spacing of the conidial septa. Of species which have roughly similar conidial shapes and similar numbers of septa *H. claviphorum*, *H. dalbergiae* and *H. velutinum* all have wider conidia and *H. cylindrosporum* has cylindrical rather than obclavate spores.

Uvariopsis congensis is a rare plant in Kenya, known only from Kakamega (Beentje, 1994). It is an element of the Guinea-Congolian

Table 1. Helminthosporium *species and their conidial characters*

	Conidial production	**Shape**	**Size (µm)**	**Septation**
acaciae M.B. Ellis	solitary	obclavate	31–49 × 10–14	3–6
ahmadii M.B. Ellis	solitary	obclavate, ± rostrate	95–150 × 25–30	5–15
apicale V.G. Rao & de Hoog	solitary	obclavate	28–38 × 7–9	4–5
bauhiniae M.B. Ellis	solitary	obclavate, rostrate	55–145 × 16–18	7–18
belgaumense Subram. & Bhat	solitary	ellipsoidal	18–24 × 15–18	1
bigenum Matsush.	solitary to catenate	obclavate to cylindrical	15–35 (–45) × 4–6·5	2–5 (–7)
catenatum Matsush.	catenate	obclavate	27–80 × 6–8·5	2–6
chlorophorae M.B. Ellis	solitary	obclavate	52–102 × 8–11	6–9
claviphorum Matsush.	solitary	obclavate	45–95 × 12–15	5–14
cubense Matsush.	mostly solitary	obclavate to cylindrical	18–63 × 6–18	3–7
cylindrosporum Matsush.	solitary	cylindrical	50–100 × 6–8·5	6–14
dalbergiae M.B. Ellis	solitary	obclavate	58–125 × 12–14	5–17
dictyoseptatum S. Hughes	solitary	obclavate, ± rostrate	92–145 × 29–38	14–18
dimorphosporum Hol.-Jech.	solitary to catenate	ellipsoidal-fusiform; obclavate, rostrate	19–24 × 8–10·5 24–65 × 10–15	1 6–9
hypselodelphyos M.B. Ellis	catenate	oblong, clavate to fusiform	15–28 × 6·5–8	1–3
kakamegense sp. nov.	solitary	obclavate	30–90 × 8–10	4–15
kalopanacis Gornostaĭ	solitary	± cylindrical	33–60 × 10–17	2–5
longisinuatum Matsush.	solitary	narrowly obclavate	65–220 × 8–10·5	many
mauritianum Cooke	solitary	obclavate	27–55 × 8–13	3–7
microsorum D. Sacc.	solitary	obclavate, rostrate	60–160 × 12–22	9–17
novae-zelandiae S. Hughes	solitary	obclavate to fusiform	56–103 × 20–24	5–8
palmigenum Matsush.	solitary	obclavate	27–47 × 6·5–9	4–9
parvum R.F. Castañeda & W.B. Kendr.	catenate	cylindric-ellipsoidal	12–27 × 7–12	1–2
senseletii Bhat & B. Sutton	catenate	cylindrical, obclavate	(10–) 20–55 × 6–9	3–6 (–9)
solani Durieu & Mont.	solitary	obclavate	24–85 × 7–12	2–9
velutinum Link	solitary	obclavate	48–118 × 11–20	6–16
zombaense B. Sutton	solitary to catenate	obclavate	26–74 × 7·5–9·5	3–5 (–10)

rainforest which extends east only as far as Kakamega and which is now very fragmented, especially in East Africa. The fungus is probably saprobic, and may well not be restricted to this host plant. However, it appeared not to be present on dead tissues of other plant species at the time of collection.

Menisporopsis trisetulosa Siboe, P.M. Kirk & P.F. Cannon, **sp. nov.**

(Fig. 4)

Etymology: *trisetulosa*, referring to the conidia with three setulae.

Ab *Menisporopsis theobromae* differt: conidia 12–20 × *ca* 2 µm, setulosa *ca* 10 µm longa, due apicali et uno sublaterali basin versus.

Colonies effuse, mycelium mostly immersed. *Synnemata* composed of a long brown seta (rarely in pairs), the lower part of which is surrounded by a cylindrical fascicle of parallel conidiophores. *Synnematal seta* central, 250–460 × 5·5–7·5 µm, about 20-septate, simple, smooth, dark brown and thick-walled at the base, rounded and paler at the tip. *Conidiophores* 120–175 µm long, unbranched, fused at the base, straight or flexuous, the lower part 2–3 µm wide, enlarging gradually over the upper quarter of their length to about 4 µm wide, terminating in single conidiogenous cells. *Conidiogenous cells* 3–3·5 µm wide, integrated, cylindrical, proliferating percurrently from a single apical locus, the whole apical region also lengthening slightly to form inconspicuous annellar thickenings, distinctly attenuated towards the apex, collarette usually inconspicuous, periclinal thickening not seen. *Conidia* aggregated in a slimy mass, 12–20 × 2 µm, allantoid, the apex acute and the base rounded, aseptate, hyaline, thin-walled, with 3 setulae *ca* 10 µm long, one at each apex and a third lateral towards the base on the convex side of the conidium, rarely with that setula branched or with a fourth one towards the base on the concave surface of the conidium.

Typification: **Kenya**: Mumias: Kakamega Forest, Buyangu, track W of Salazar Circuit towards river Isiukho, on dead fallen leaves of *Tiliacora kenyensis*, 19 Jul. 1997, *P.F. Cannon* 77 (**IMI** 376543 - holotype).

Menisporopsis previously contained seven species. The genus is characterized by synnematous colonies with a central dark seta surrounded by a cluster of dark hyphae terminating in pale variably differentiated conidiogenous cells which primarily proliferate percurrently, and some

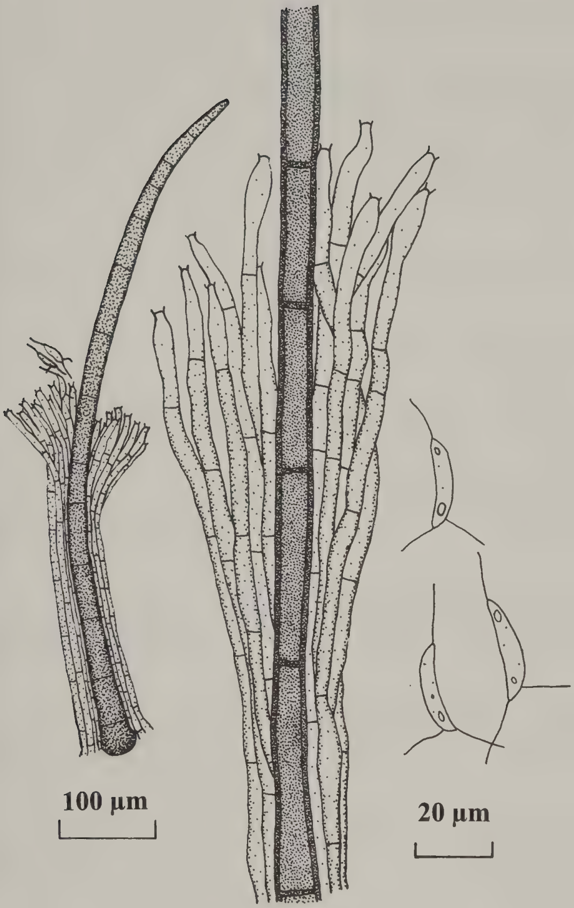

Fig. 4. *Menisporopsis multisetulata* (from holotype).

species have conspicuously flared collarettes. Conidia are hyaline, usually aseptate, and setulose. These fungi should probably be assigned as anamorphic members of the *Trichosphaeriaceae* (*Ascomycota*).

The new species is probably most closely related to *Menisporopsis theobromae* S. Hughes and *M. multisetulata* K.M. Tsui, Goh, K.D. Hyde & Hodgkiss, which have similarly sized and shaped conidia. In the former there are only two apical setulae whilst in the latter there are 2–3 short apical setulae in addition to the long one and the lateral setula at the base may be long or short. *Menisporopsis theobromae* is widely distributed throughout the

Key to currently accepted species of Menisporopsis

1	Synnematal setae usually forked, sometimes with hyaline extensions; conidiophores in basal fascicles, not surrounding the seta	**ludoviciana**
	Synnematal setae simple, with the conidiophores surrounding the seta	2
2	Conidiogenous cells with conspicuously flared collarettes	3
	Collarettes absent or inconspicuous	5
3	Conidiogenous cells with multiple conidiogenous loci; conidia 12–15 × 2–2·5 µm with two apical setulae 4·5–6 µm long	**profusa**
	Conidiogenous cells simple, with a single apical conidiogenous locus	4
4	Conidiophores in fascicles of up to 40; conidia 15–18 × 2·5–3 µm with a median septum and a single setula at each apex	**novae-zelandiae**
	Conidiophores in clusters of 6–12; conidia 17–20·5 × 2·5–3·5 µm, aseptate, with two setulae at each apex	**pirozynskii**
5	Conidia 14–18 × 2–3 µm, slightly curved, with a single setula at each apex	**theobromae**
	Conidia with more than two setulae	6
6	Conidia 12–18 × 4–5 µm, fusiform, the base truncate, with a single apical and two to four basal setulae	**pleiosetosa**
	Conidia allantoid	7
7	Conidia 12–20 × 2 µm, with one setula at the apex and one terminal and one lateral at the base	**trisetulosa**
	Conidia 12–18 × 2·5–4 µm, with one long and two short setulae at the apex and one terminal and one lateral (long or short) at the base	**multisetulata**

Old World tropics, and has been recorded from Tanzania on the related host *Tiliacora funifera*; *M. multisetulata* is only known from Hong Kong. *Menisporopsis pleioseta* V.G. Rao & de Hoog has conidia which sometimes have three setulae, but the conidia are fusiform with a truncate base. The only other species of *Menisporopsis* currently known from Kenya is *M. novae-zelandiae* S. Hughes & W.B. Kendr., which has been found several times on leaf litter of *Ocotea usumbarensis* from the southern slopes of Mount Kenya.

Other collection examined: **Kenya**: Mount Kenya, Castle Forest, on leaf litter, 25 Jan. 1984, *P.M. Kirk* 1508 (**IMI** 285176a).

Phaeoisaria muscariformis Siboe, P.M. Kirk & P.F. Cannon, **sp. nov.**
(Fig. 5)

Etymology: *muscariformis*, derived from *muscarium*, a fly-swat, recalling the shape of the synnemata.

Ab *Phaeoisaria triseptata* differt: denticuli inconspicui in cellulis conidiogenis, et conidia 12–22 × *ca* 4 µm, recta, cylindric-ellipsoidea.

Colonies effuse, tufted or scattered, dark brown. *Mycelium* mostly superficial. *Conidiophores* macronematous, synnematous, individual threads pale brown, branched towards the apex, 400–1000 µm high, smooth, mostly flexuous, splaying out at the apex. *Conidiogenous cells* narrowly clavate, polyblastic, integrated and terminal, proliferating sympodially, the conidiogenous loci denticulate; denticles cylindrical, *ca.* 1 µm diam. *Conidia* 12–22 × 4 µm, fusiform, 3-septate, subhyaline, smooth, solitary, dry, acropleurogenous.

Typification: **Kenya**: Mumias, Kakamega Forest, Buyangu, Isiukho River trail, on living leaves of *Tiliacora kenyensis*, 18 Jul. 1997, *G.M. Siboe* 26 (**IMI** 376525 - holotype).

Phaeoisaria muscariformis has only been found growing on leaves of *Tiliacora kenyensis*, a climbing plant of the *Menispermaceae* which is not known to occur outside of the Kakamega Forest (Troupin, 1956; Beentje, 1994). As the fungus typically fruits on living leaves and apparently does not cause significant damage to the host, it may well be specific to that plant. Its mode of nutrition is not clear. The closely related *Tiliacora funifera* is widespread in eastern and western tropical Africa and may also harbour the

Phaeoisaria. Further work will be necessary to assess the conservation status of *P. muscariformis*.

The most recent monograph of *Phaeoisaria* is that of de Hoog & Papendorf (1976), who accepted six species, and a further five have subsequently been described. This further species is characterized particularly by its large three-septate conidia. The only other species with these characters is *P. triseptata*, described from Cuba by Holubová-Jechová (1988), which has wider and slightly curved conidia, formed from conidiogenous loci with much more prominent denticles than those of *P. muscariformis*. A species of *Phaeoisaria*, morphologically very similar to *P. clematidis* (Fuckel) S. Hughes, has been connected with the teleomorph genus *Peroneutypella* Berl. by Deighton (1974), which was subsequently placed into synonymy with *Scoptria* by Rappaz (1987). These taxa are poorly understood and used in conflicting applications (Barr, 1985; Rappaz, 1987). The systematic affinities of *Phaeoisaria* are not clear, but the similarities with *Harpographium* Sacc. observed by Deighton (1974) may well be a reflection of joint ancestry.

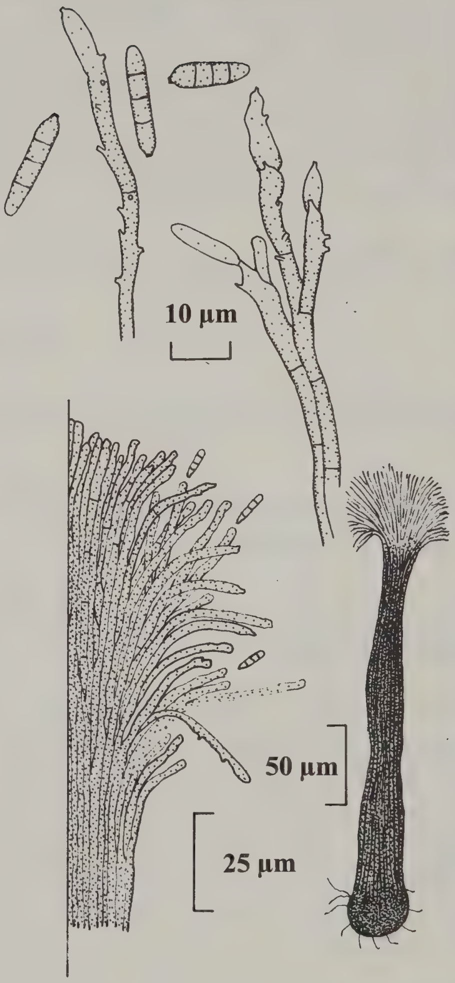

Fig. 5. *Phaeoisaria muscariformis* (from holotype).

Other collections examined: **Kenya**: Mumias, Kakamega Forest, Buyangu, track W of Salazar Circuit towards river Isiukho, on living leaves of *Tiliacora kenyensis*, 19 Jul. 1997, *P.F. Cannon* 54 (**IMI** 376442); Mumias, Kakamega Forest, Buyangu, track W of Salazar Circuit towards river Isiukho, on dead fallen leaves of *Tiliacora kenyensis*, 19 Jul. 1997, *P.F. Cannon* 77 (**IMI** 376540).

Key to currently accepted species of Phaeoisaria (partially based on de Hoog & Papendorf, 1976)

1 Conidia at least mostly longer than 8 µm 2
Conidia at least mostly shorter than 8 µm 7

2 Conidia aseptate, rarely 1-septate 3
Conidia 3-septate 6

3 Synnemata narrow, composed of only 5–6 brown adpressed hyphae; conidia falcate, 19·5–22 × 2–3 µm .... **infrafertilis**
Synnemata composed of at least 10 adpressed hyphae; conidia straight 4

4 Conidiophores conspicuously tuberculate; conidia fusiform, 8–13·5 × 1·5–2 µm, the apex attenuated .... **tuberculata**
Conidiophores not tuberculate; conidia ± ellipsoidal, not attenuated at the apex 5

5 Synnemata fertile only at the apex; conidia ellipsoidal to fusiform, 10–15·5 × 2·5–3·5 µm, sometimes septate .... **sparsa**
Synnemata fertile over most of their surface; conidia ellipsoidal to clavate, 7·5–12 × 2·5–3·5 µm .... **caffra**

6 Conidiogenous loci strongly denticulate; conidia clavate-ellipsoidal, 15–20 × 5–6·5 µm .... **triseptata**
Conidiogenous loci hardly denticulate; conidia cylindric-ellipsoidal, 12–22 × *ca* 4 µm .... **muscariformis**

7 Conidiogenous cells narrow, with attenuated apical portions on which denticulate conidiogenous loci are formed; conidia 1–2 µm long, broadly ellipsoidal to ± spherical .... **clavulata**
Conidiogenous cells without attenuated apical portions; conidia mostly ellipsoidal to clavate, > 2 µm long 8

8 Conidia (3·5–) 5·5–7·5 (–10) × 1·5–3 µm, mostly with a median septum .... **uniseptata**
Conidia aseptate 9

9 Conidia 2·5–3·5 × 1·5–2·5 µm, obovoid .... **glauca**
Conidia at least mostly > 4 µm long 10

10 Conidia mostly curved, (4–) 6–8 (–11) × (1–) 2–3 µm, clavate to falcate .... **curvata**
Conidia straight, ellipsoidal to obovoid 11

11 Synnemata brush-like, the conidiophores growing well away from the column in the apical portion; conidia 5–6·5 × 4–4·5 µm .... **magnifica**
Synnemata cylindrical, the conidiophores hardly extending away from the column; conidia (4·5–) 6–8 (–10) × 1·5–4 µm, ellipsoidal to fusiform at the base acute .... **clematidis**

Piperivora nodosa Siboe, P.M. Kirk & P.F. Cannon, **gen. et sp. nov.**
(Fig. 6)

Etymology: *Piperivora*, from *Piper*, the host genus and *-vora*, indicating its nutrition.

Ab *Gonatophragmium* differt: conidiophorae caespitosae, stromaticae, verruculosae. Loci conidiogenae circumnexi, conidia recta, uniseptata.

Colonies tufted or cottony, sometimes reduced, developing from pale brown roughly circular leaf spots. *Mycelium* immersed. *Stroma* present but rudimentary, composed of a small basal pad of pale brown thin-walled *textura angularis* with cells to *ca* 4 µm diam. *Conidiophores* 165–300 × 2–3

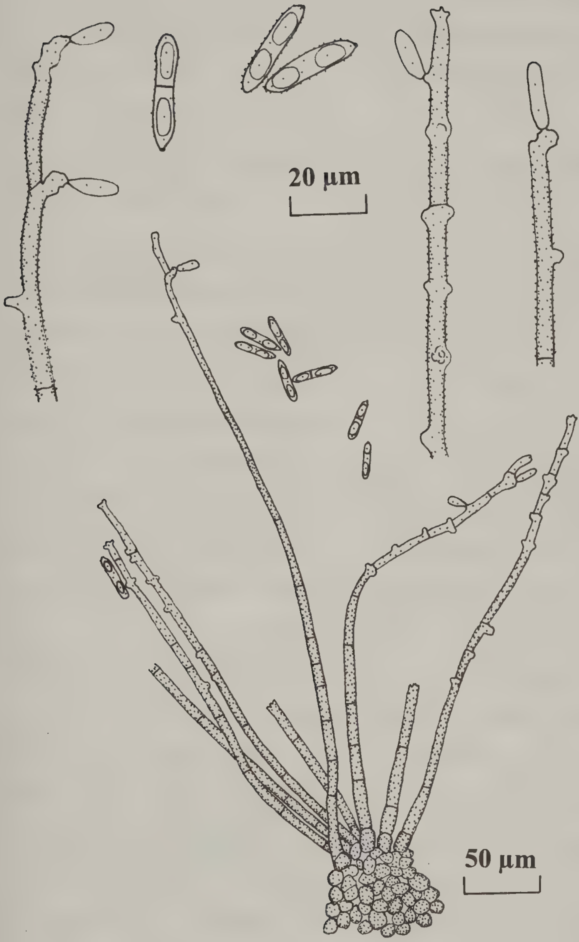

Fig. 6. *Piperivora nodosa* (from holotype).

µm, mononematous, formed in irregular loose tufts, branched at right angles, flexuous, pale olivaceous brown, thin-walled, verruculose with nodose conidiogenous loci formed below the slightly thickened septa at intervals of 10–18 µm, occasionally fragmenting towards the apex to form short chains of conidia. *Conidiogenous loci* intercalary or terminal, strongly nodose, with scars visible in rings of 3–4, individual loci probably not forming conidia successively. *Conidia* 10·5–18 × 3–4 µm, usually not forming chains, dry, cylindrical, the apices acute to obtuse, basal scar inconspicuous, 0- to 1-septate, almost hyaline, often guttulate, smooth or very faintly verruculose, thin-walled.

Typification: **Kenya**: Mumias, Kakamega Forest, Isiukhu river trail, 00°19'N, 34°52'E, 1580m alt., on living leaves of *Piper guineense*, 18 Jul. 1997, *G.M. Siboe* 56 (**IMI** 376523 - holotype).

Piperivora shares a number of morphological features with the genus *Gonatophragmium* (Ellis, 1971, 1976; Rai, 1996) but differs as its conidiophores, which are formed in tufts from a small basal stroma and are verruculose rather than smooth-walled. In addition, the conidiogenous loci are arranged around the circumference of the swollen conidiophore cells rather than on lateral swellings and the conidia are straight and 1-septate rather than curved and multiseptate. The overall appearance of the fungus suggests a link with the *Dothideales*. *Gonatophragmium* has been stated to be an anamorph of the genus *Acrospermum* by Takahashi & Teramine (1986), though their work needs confirmation. *Acrospermum* is the type genus of the *Acrospermaceae* (*Ascomycota* 'incertae sedis'; Hawksworth *et al*., 1995) and is most unlikely to be linked with the *Dothideales*.

Piperivora is similar in some respects to *Gonatophragmiella* (Kumar *et al*., 1994) but that has simple smooth-walled conidiophores formed from aerial mycelium as well as basal stromata, and the conidiogenous loci are either terminal or less strongly nodose than in *Piperivora*. *Gonatophragmiella* is not validly published (anon., *Index of Fungi*) and may be a synonym of *Denticularia* Deighton. Other morphologically comparable genera include: *Dactylaria* Sacc. (stroma absent, conidiophores dark brown, unbranched, smooth and thick-walled, conidiogenous loci not strongly clustered); *Phaeodactylium* Agnihothr. (stroma lacking, conidiophores smooth, conidiogenous loci less strongly nodose, conidia multiseptate); and *Redbia* Deighton & Piroz. (stroma absent, conidiophores smooth, less branched, conidiogenous loci not arranged in nodose swellings below the septa). The genus *Bidenticula* Deighton as described by the original author and Ellis (1976) has many features in common with *Piperivora*, but the type material seems to be a mixture of an unidentified dematiaceous hyphomycete and a *Fusarium* hyperparasite or competitor (Booth & Sutton (*in litt.*) in Hawksworth *et al*., 1995).

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REFERENCES

Barr, M.E. (1985). Notes on the *Calosphaeriales*. *Mycologia* **77**: 549–565.

Beentje, H.J. (1994). *Kenya Trees, Shrubs and Lianas*. 722 pp. Nairobi: National Museums of Kenya.

Deighton, F.C. (1974). Four synnematous hyphomycetes. *Transactions of the British Mycological Society* **62**: 243–252.

Ellis, M.B. (1961). Dematiaceous hyphomycetes. III. *Mycological Papers* **82**: 55 pp.

Ellis, M.B. (1971). *Dematiaceous Hyphomycetes*. 608 pp. Kew: Commonwealth Mycological Institute.

Ellis, M.B. (1976). *More Dematiaceous Hyphomycetes*. 507 pp. Kew: Commonwealth Mycological Institute.

Guo, Ying-lan (1984). [Four new species of the genus *Corynespora*]. *Acta Mycologica Sinica* **3**: 161–169.

Hawksworth, D.L., Kirk, P.M., Sutton, B.C. & Pegler, D.N. (Eds) (1995). *Ainsworth & Bisby's Dictionary of the Fungi*. Edn 8, 616 pp. Wallingford, UK: CAB International.

Holubová-Jechová, V. (1988). Studies on hyphomycetes from Cuba VII. Seven new taxa of dematiaceous hyphomycetes. *Česká Mykologie* **42**: 23–30.

Hoog, G.S. de & Papendorf, M.C. (1976). The genus *Phaeoisaria*. *Persoonia* **8**: 407–414.

Kumar, Rai, A.N. & Kamal (1994). Two new hyphomycetes from Indian subcontinent. *Indian Phytopathology* **47**: 127–132.

Meenu, Singh, A. & Singh, S.K. (1997). Some new species of *Corynespora*. *Indian Phytopathology* **50**: 17–24.

Rai, A.N. (1996). A new species of *Gonatophragmium* from the forest flora of the Indian subcontinent. *Mycological Research* **100**: 1263–1264.

Rappaz, F. (1987). Taxonomie et nomenclature des Diatrypacées à asques octosporés. *Mycologia Helvetica* **2**: 285–648.

Shoemaker, R.A. (1959). Nomenclature of *Drechslera* and *Bipolaris*, grass parasites segregated from '*Helminthosporium*'. *Canadian Journal of Botany* **37**: 879–887.

Takahashi, K. & Teramine, T. (1986). Zonate leaf spot of mulberry, with special reference to the life-cycle and taxonomy of causal fungus *Gonatophragmium mori*. *Annals of the Phytopathological Society of Japan* **52**: 404–412.

Troupin, G. (1956). *Flora of Tropical East Africa. Menispermaceae* [Turrill, W.B. & Milne-Redhead, E., Eds]. 32 pp. London: Crown Agents.

Tsui, K.M., Goh, T.K., Hyde, K.D. & Hodgkiss, I.J. (1999). Reflections on *Menisporiopsis*, with the addition of *M. multisetulata* sp. nov. from submerged wood in Hong Kong. *Mycological Research* **103**: 148–152.

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NOTES ON HYPHOMYCETES. LXXV. NEW SPECIES OF BRACHYSPORIELLA AND OF THE PREVIOUSLY MONOTYPIC GENUS ITYORHOPTRUM ON DECORTICATED WOOD IN SOUTHERN AFRICA

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ABSTRACT

One new species each of *Brachysporiella* Batista and of the previously monotypic genus *Ityorhoptrum* Kirk, namely *B. biseptata* and *I. natalense*, are described and illustrated from collections made on decaying wood in Natal Province, Republic of South Africa. Both taxa have the essential characteristics of their respective genera, although differing in some notable degree from the type species thereof.

INTRODUCTION

As part of our studies of dematiaceous Hyphomycetes occurring on dead wood in southern Africa (Morgan-Jones, 1982; Morgan-Jones *et al.*, 1983; 1987a; 1987b; Sinclair *et al.*, 1987) [see also Sinclair (1990)], collections have hitherto been reported from a number of localities. These include the Mariepskop Forest Reserve in the Drakensberg Mountains of northeastern Transvaal, the Serala State Forest, near Tzaneen, also in the northeastern

Transvaal, the Golden Gate Highlands National Park in the Orange Free State and Mbotyi in the Transkei. In all geographical areas, similar habitats were selected, mainly in montane or submontane forests, typically in moist and sheltered kloofs. More recently, collections have been made at two additional localities, in the Drakensberg Mountains of northwestern Natal within the *Podocarpus latifolius* forest vegetation belt; the Royal Natal National Park and the Giant's Castle Game Reserve. They will be reported upon in this and subsequent papers in this series. Further collections have also been made at Mariepskop. Among microfungi encountered in these newer collections are two species which we believe to be undescribed, belonging to the genera *Brachysporiella* and *Ityorhoptrum*. They are treated herein.

During the course of a review and taxonomic revision of entities classified under the generic name *Endophragmia* Duvernoy & Marie (1920), which was considered untenable on grounds of typification difficulties and therefore a *nomen dubium*, Hughes (1979) relocated the majority of the known species to other genera. Morgan-Jones and Cole (1964) and Sutton (1973) had previously noted the somewhat heterogeneous nature of the genus as conceived and circumscribed by Ellis (1971). Most species were reclassified by Hughes (loc. cit.) in the genus *Endophragmiella* Sutton, while a few others were transferred to *Sporidesmium* Link and a new genus, *Melanocephala* S. Hughes. One species was placed in *Acremoniula* Ciferri and the use of the generic name *Phragmocephala* Mason & Hughes was resurrected for several. Accommodation in *Sporidesmium* of six species previously classified in *Endophragmia* was qualified by a statement to the effect that the latter genus also remained heterogeneous and that eventual segregation of taxa within it might become warranted. In the same year, Sutton and Hodges (1979) also expressed a similar view of the diverse nature of *Sporidesmium.* Kirk (1982) thereafter came to the same conclusion and established the genus *Sporidesmiella* Kirk for two previously undescribed species and four which Hughes (loc. cit.) had removed from *Endophragmia* and placed in *Sporidesmium*.

The generic name *Brachysporiella,* typified by *B. gayana* Batista, was accepted by Hughes (loc. cit.) although one of the species classified within it, *B. laxa* (Hudson) M.B. Ellis, which had originally been described in *Endophragmia*, was transferred to *Paradendryphiopsis* M.B. Ellis. The genus *Edmundmasonia* Subramanian was recognized to be a synonym of *Brachysporiella* and its type species, *E. pulchra* Subramanian, was accordingly transferred to that genus.

In addition to the taxa reclassified elsewhere, Hughes (loc. cit.) discussed a number of species which he considered to be of uncertain position. Included among these were *Endophragmia catenulata* M.B. Ellis and *Endophragmia verruculosa* M.B. Ellis. Kirk (1986) subsequently established the monotypic generic names *Kionocephala* Kirk and *Ityorhoptrum* Kirk, respectively, for these entities. The latter genus was characterized by possession of conidia which differ from those of *Endophragmiella* in that they secede schizolytically rather than rhexolytically and do not exhibit the somewhat prominent circumscissile basal frill derived from the torn apex of the conidiogenous cell.

In the development of a satisfactory taxonomy for anamorphic fungi belonging to this complex attention has been paid not only to particulars of conidium detachment but to morphology of conidiophores and conidia. Of those genera, including *Acrogenospora* M.B. Ellis, *Brachysporiella*, *Ityorhoptrum*, and *Monotosporella* S. Hughes, in which conidia secede by a schizolytic splitting of a basal septum, presence or absence of conidial septation, conidium shape, as well as details of conidiophore morphology and proliferation, are the main criteria by which each is conceptualized and circumscribed. In reaching a decision to classify the two novel taxa described herein within the genera *Brachysporiella* and *Ityorhoptrum*, respectively, consideration was given to certain monothetic hallmark characteristics.

TAXONOMIC PART

Brachysporiella biseptata Baker et Partridge sp. nov. (Figure 1)

Coloniae effusae, pilosae, atrobrunneae, sparsae. Mycelium in substrato immersum, ex hyphis ramosis, septatis, brunneis, laevibus, 2-3µ crassis compositum. Conidiophora macronemata, mononemata, ex apice lateribusque hypharum oriunda, erecta, recta vel leniter curvata, simplicia, septata, laevia, brunnea vel pallide brunnea, apicem versus pallidiora, plerumque ad proliferationes successivas ampulliformes elongascienta, 90-210µ longa, 4-8µ crassa, basi inflata, 10-14µ lata. Cellulae conidiogenae holoblasticae, in conidiophoris incorporatae, terminales, percurrentes. Conidia solitaria, sicca, acrogena, obovoidea vel obclavata, ad basim truncata, laevia, 1-2-septata, brunnea, cellula inferiorae pallidissima, 23-30µ longa, 10-14µ crassa, basi 4-6µ lata.

In lignis putredinis, Gorge path near Tugela River, Mont-Aux-Sources, Royal Natal National Park, South Africa, 16 January 1992, G. Morgan-Jones, AUA, holotypus.

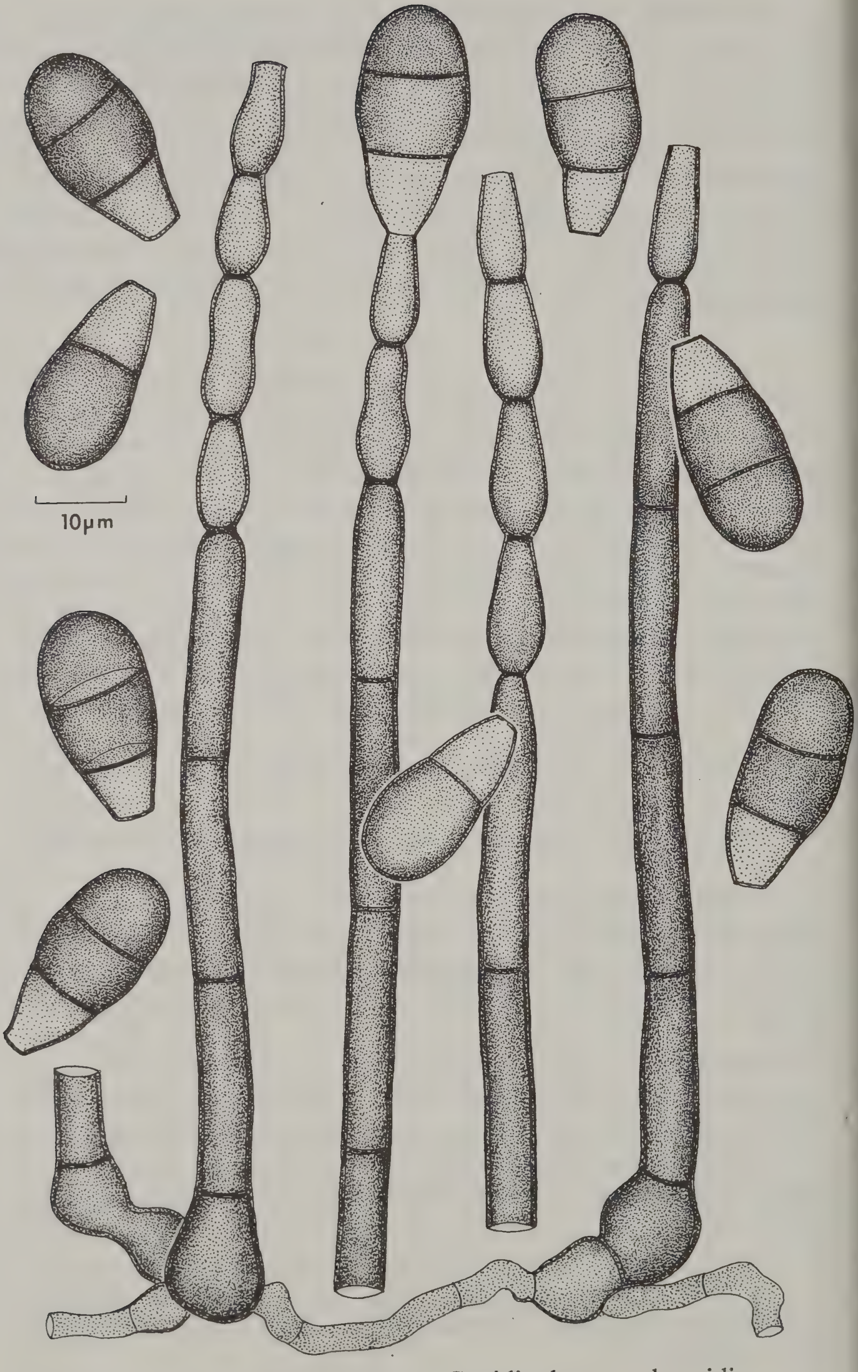

FIGURE 1. *Brachysporiella biseptata.* Conidiophores and conidia.

Colonies spreading, hairy, dark brown to black, somewhat sparse. Mycelium immersed in the substratum, composed of branched, septate, mid brown, smooth, 2-3μ wide hyphae. Hyphae often undulating with occasional, irregularly swollen cells. Conidiophores macronematous, mononematous, arising terminally or laterally from inflated hyphal cells, erect, straight or gently curved, unbranched, septate, smooth, brown to pale brown, thick-walled, discernibly paler toward the apex, frequently extending in length by successive, percurrent, flask-shaped or narrowly hourglass-shaped or somewhat barrel-shaped proliferations, with a narrow, dark band at the locus of each successive proliferation, 90-210μ long, 4-8μ wide, base inflated, frequently bulbous, 10-14μ in diameter. Conidiogenous cells holoblastic, integrated, terminal, percurrent. Conidia solitary, dry, acrogenous, obovoid to obclavate, usually straight or, occasionally, moderately bent, sometimes very slightly constricted at the septa, broadly obtuse at the apex, subtruncate to truncate at the base, smooth, 1-2 septate, distal cell brown to dark brown, subtending cells progressively paler, 23-30μ long, 10-14μ wide, base 4-6μ in diameter, seceding schizolytically.

On decaying wood, Gorge path near Tugela River, Mont-Aux-Sources, Royal Natal National Park, South Africa, 16 January 1992, G. Morgan-Jones, AUA, holotype.

This taxon is being placed in *Brachysporiella* advisedly, on account of the fact that the conidiophores are not branched. With regard to conidium morphology and the presence of more or less ampulliform to obpyriform conidiophore proliferations, arising successively from the half-septa remaining after schizolytic conidium secession, it is, however, quite similar to *B. gayana*. A number of researchers have, in fact, noted the presence of unbranched conidiophores in the type species. Ellis (1959), Tubaki (1973), Matsushima (1975), and Hughes (1978) all reported the frequent occurrence of simple conidiophores in *B. gayana*. The narrow, darkly-pigmented bands at the juncture of each proliferation is another feature which *B. biseptata* shares in common with *B. gayana*. Interestingly, similarly-shaped conidiophore proliferations with a banded effect also occur in some other dematiaceous Hyphomycetes in which conidium detachment occurs schizolytically. These include *Monotosporella setosa* (Berk. & Curt.) S. Hughes and a number of species of *Sporidesmium* such as *S. australiense* M.B. Ellis, *S. bambusae* M.B. Ellis, *S. flagellatum* (S. Hughes) M.B. Ellis, and *S. nodipes* (Penz. & Sacc.) S. Hughes. Such are also present in *Ellisembia opaca* (Cooke & Hark.) Subram., where the banding pattern is very pronounced. Subramanian (1992) established the generic name *Ellisembia* Subram., type species *E. coronata* (Fuckel) Subram., for several species producing distoseptate conidia previously classified in *Sporidesmium*, which have either percurrently proliferating or determinate, non-proliferating conidiophores.

Ityorhoptrum natalense Baker et Partridge sp. nov. (Figure 2)

Coloniae effusae, pilosae, atrobrunneae, sparsae. Mycelium in substrato immersum, ex hyphis ramosis, septatis, brunneis, laevibus, 2-4μ crassis compositum. Conidiophora macronemata, mononemata, ex apice lateribusque hypharum oriunda, erecta, recta vel leniter curvata, simplicia, septata, laevia, brunnea vel pallide brunnea, apicem versus pallidiora, 70-140μ longa, 3-4μ crassa, basi inflata, 5-6μ lata. Cellulae conidiogenae holoblasticae, in conidiophoris incorporatae, terminales, percurrentes. Conidia solitaria, sicca, acrogena, anguste obovoidea, ad basim truncata, laevia, 0-1-septata, cellula superiorae brunnea, cellula inferiorae pallide brunnea, 11-14μ longa, 5-7μ crassa, basi 3-4μ lata.

In lignis putredinis, forest below bushman's caves, Giant's Castle Game Reserve, South Africa, 17 January 1992, G. Morgan-Jones, AUA, holotypus.

Colonies spreading, hairy, dark brown to black, thin, sparse. Mycelium immersed in the substratum, composed of branched, septate, brown, smooth, 2-4μ wide hyphae. Hyphal elements occasionally swollen. Conidiophores macronematous, mononematous, often somewhat caespitose and gregarious in clusters of two or three, arising terminally or laterally, erect, straight or gently curved, unbranched, septate, smooth, brown to pale brown, moderately thick-walled, paler toward the apex, 70-140μ long, 3-4μ wide, base inflated, often slightly bulbous, 5-6μ in diameter. Conidiogenous cells holoblastic, integrated, terminal, percurrent, with one or two thin, circumscissile annellations, extensions cylindrical, appreciably paler. Conidia solitary, dry, acrogenous, often remaining affixed to the conidiophore periclinal wall in a lateral orientation following detachment, narrowly obovoid or short clavate, truncate at the base, smooth, 0-1-septate, distal cell brown, proximal cell pale brown, 11-14μ long, 5-7μ wide, base 3-4μ in diameter, seceding schizolytically.

On decaying wood, forest below bushman's caves, Giant's Castle Game Reserve, South Africa, 17 January 1992, G. Morgan-Jones, AUA, holotype.

This species is also classified herein advisedly, since it differs in some respects from the type species of *Ityorhoptrum*, *I. verruculosum* (M.B. Ellis) Kirk. In the one-septate conidium of *I. verruculosum* the upper cell is quite thick-walled and coarsely verruculose, whereas in *I. natalense* the distal cell is comparatively thinner-walled and smooth. Moreover, the truncate conidial

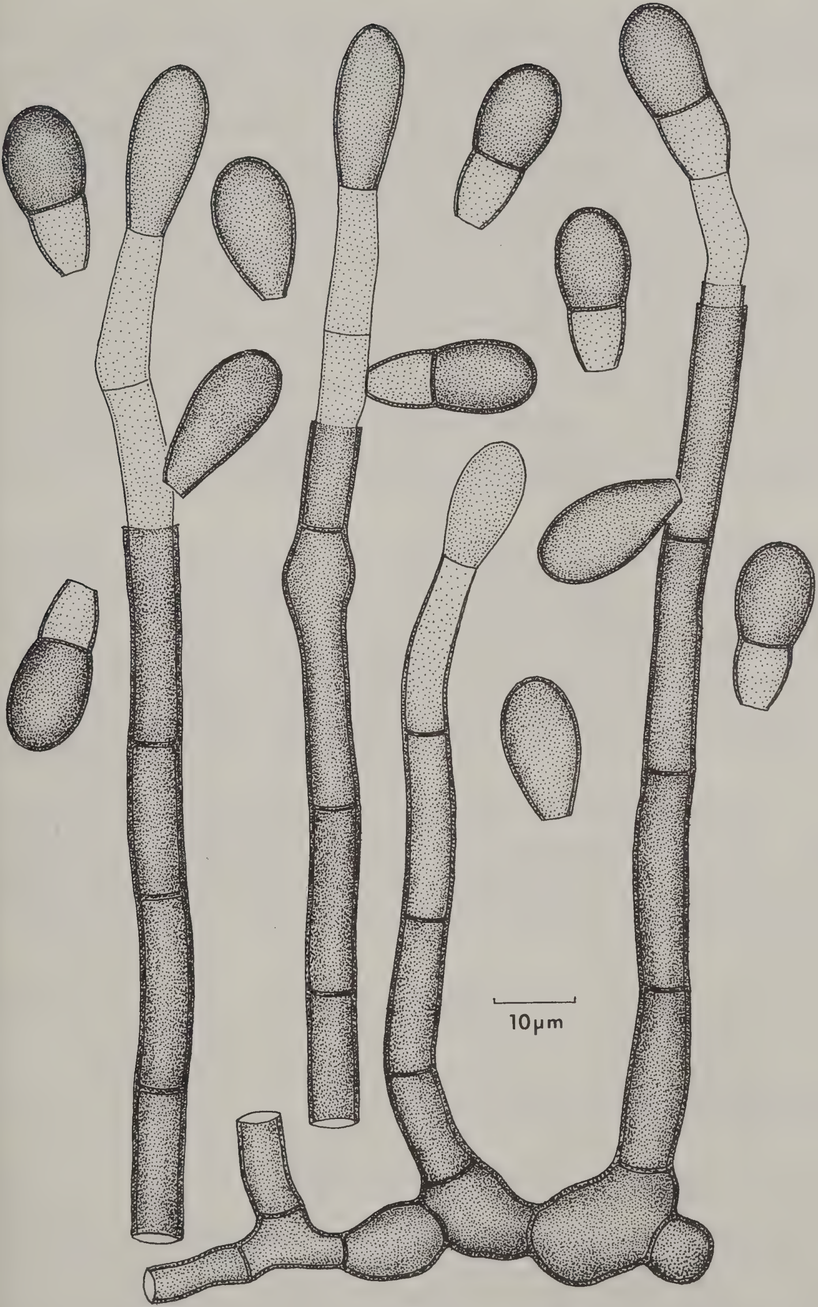

FIGURE 2. *Ityorhoptrum natalense.* Conidiophores and conidia.

base of *I. verruculosum* bears a minute frill of outer wall material at its periclinal circumference, although this does not result from rhexolytic detachment. In contrast, the base of *I. natalense* comes off cleanly and evenly, not to mention the presence of more noticeably flared annellations on the conidiophores of the type species. The conidiophores of the two species are, however, essentially similar with a thin annellation occurring at each conidiogenous locus following percurrent proliferation. The concept of the genus *Ityorhoptrum* is essentially based upon possession of obovoid, euseptate conidia with few septa, in comparison with *Sporidesmiella* which has distoseptate conidia and *Sporidesmium* where conidia are predominantly pluriseptate. Notwithstanding the differences, we consider *Ityorhoptrum* to be the only available genus in which to classify this taxon. The alternative would be to establish a new genus in which to accommodate it, an action which seems unnecessary and could not be justified at present given the segregating that has already been accomplished in this complex.

Ityorhoptrum verruculosum possesses a rather unique pattern of transverse septum formation at the distal end of its conidiophore in relation to successive percurrent proliferation. A septum is regularly laid down in the proliferated portion of the terminal conidiogenous cell a short distance above or below the annellation left behind following each conidium secession. In *I. natalense* a septum may be formed in the proliferated extension some distance above the annellation or this part of the conidiophore may remain continuous.

The peculiarity of conidia remaining laterally attached to conidiophore side walls following secession is also a feature which both these species share. This also occurs in several other taxa belonging to this complex, for example in *Acrogenospora* and some species of *Sporidesmiella*, such as *S. parva* (M.B. Ellis) Kirk.

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LITERATURE CITED

DUVERNOY, A. and R. MARIE. 1920. Une nouvelle Dématiée à conidies pseudo-endogènes. *Bull. Soc. Mycol. Fr.* 36:86-89.

ELLIS, M.B. 1959. *Clasterosporium* and some allied Dematiaceae-Phragmosporae. II. *Mycol. Pap.* 72:1-75.

ELLIS, M.B. 1971. Dematiaceous Hyphomycetes. Commonwealth Mycological Institute. 608 pp.

HUGHES, S.J. 1978. New Zealand Fungi 25. Miscellaneous species. *N. Z. J. Bot.* 16:311-370.

HUGHES, S.J. 1979. Relocation of species of *Endophragmia* auct. with notes on relevant generic names. *N. Z. J. Bot.* 17:139-188.

KIRK, P.M. 1982. New or interesting microfungi. VI. *Sporidesmiella* gen. nov. (Hyphomycetes). *Trans. Br. mycol. Soc.* 79:479-484.

KIRK, P.M. 1986. New or interesting microfungi. XV. Miscellaneous Hyphomycetes from the British Isles. *Trans. Br. mycol. Soc.* 86:409-428.

MATSUSHIMA, T. 1975. Icones microfungorum a Matsushima lectorum. Published by the author. Kobe, Japan. 209 pp.

MORGAN-JONES, G. 1982. Notes on Hyphomycetes. XLII. New species of *Acrodictys* and *Pseudospiropes* from South Africa. *Mycotaxon* 16:187-191.

MORGAN-JONES, G. and A.J.L. COLE. 1964. Concerning *Endophragmia hyalosperma* (Corda) comb. nov. *Trans. Br. mycol. Soc.* 47:489-495.

MORGAN-JONES, G., R.C. SINCLAIR and A. EICKER. 1983. Notes on Hyphomycetes. XLIV. New and rare dematiaceous species from the Transvaal. *Mycotaxon* 17:301-316.

MORGAN-JONES, G., R.C. SINCLAIR and A. EICKER. 1987a. Notes on Hyphomycetes. LIII. *Monotretomyces*, a new dematiaceous, catenate genus. *Mycotaxon* 29:353-358.

MORGAN-JONES, G., R.C. SINCLAIR and A. EICKER. 1987b. Notes on Hyphomycetes. LV. *Craneomyces verrucosus* gen. nov., and *Trichobotrys effusa*. *Mycotaxon* 30:345-350.

SINCLAIR, R.C., A. EICKER and G. MORGAN-JONES. 1987. Notes on Hyphomycetes. LVI. *Ceratosporella cheiroidea*, a new species. *Mycotaxon* 30:351-358.

SINCLAIR, R.C. 1990. A taxonomic study of some saprophytic Hyphomycetes of southern Africa. Ph.D. Thesis, University of Pretoria, 168 pp.

SUBRAMANIAN, C.V. 1992. A reassessment of *Sporidesmium* (Hyphomycetes) and some related taxa. *Proc. Indian Nat. Sci. Acad.* B58 4:179-190.

SUTTON, B.C. 1973. Hyphomycetes from Manitoba and Saskatchewan, Canada. *Mycol. Pap.* 132:1-143.

SUTTON, B.C. and C.S. HODGES, JR. 1979. *Eucalyptus* microfungi. Miscellaneous Hyphomycetes. *Nova Hedwigia* 28:487-498.

TUBAKI, K. 1973. Descriptive catalogue of I.F.O. Culture Collection, Fungus Collection III. *Inst. Ferment. Res. Commun. (Osaka)* 6:83-94.

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Fungi from Mauritius: three new hyphomycete species on endemic plants

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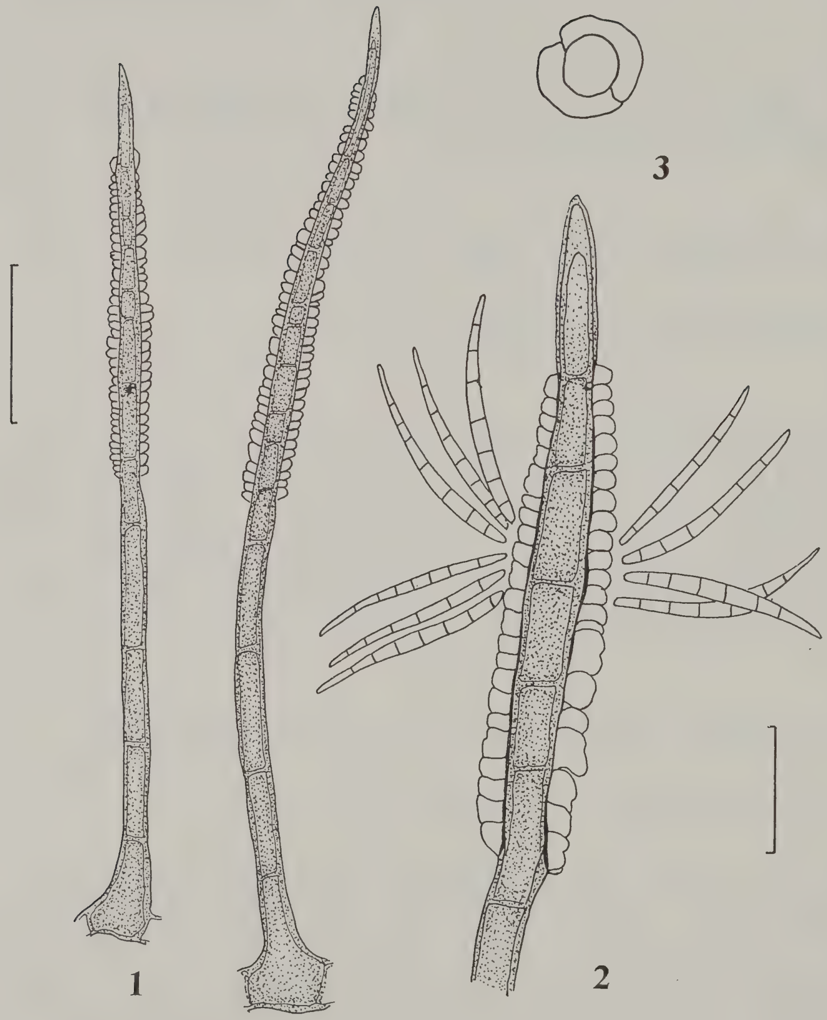
During studies of leaf litter fungi in the native forests in the management reserve plots of the Black River Gorges National Park, Mauritius, several collections have been made on endemic *Pandanus barklyi* Balf. f. and *Sideroxylon puberulum* DC. These collections included three new hyphomycete species: *Cryptophiale pandanicola*, *Linodochium sideroxyli* and *Spadicoides mauritiana*. They are described here and compared with other related species in their respective genera.

Cryptophiale pandanicola Dulymam., P.M. Kirk & Peerally, sp. nov.
Figs 1–4

Etymology: *pandanicola*, in reference to the host genus.

Coloniae effusae, pilosae. *Mycelium* immersum, ex hyphis ramosis, septatis, brunneis, 3–4 µm latis compositum. *Conidiophora* macronematosa, mononematosa, solitaria, erecta, non-ramosa, atro-brunnea, laevia, crassitunicata, multiseptata, basim tumidus, regionem fertilitem versus deminuta sed in regione fertili leviter latiora, denum apicem acutum abrupte demunita, usque ad 360 µm longa, ad basim 8–10 µm lata, ad apicem 6–8 µm lata. *Regio fertilis* 75–114 µm longa, 16–24 µm lata, cylindrica, atro-brunnea, septata; apice conidiphorum acuto, 18–30 µm longa. *Conidia* hyalina, laevia, 7–10-septata, ad septa constricta, apice appendiculata, 72–95 × 2·5–3 µm.



Figs 1–3. *Cryptophiale pandanicola* (from holotye). 1. Conidiophore; 2. Fertile region of conidiophore; 3. Cross section of fertile zone. Scale bars: Fig. 1: 50 µm; Figs 2–3: 10 µm.

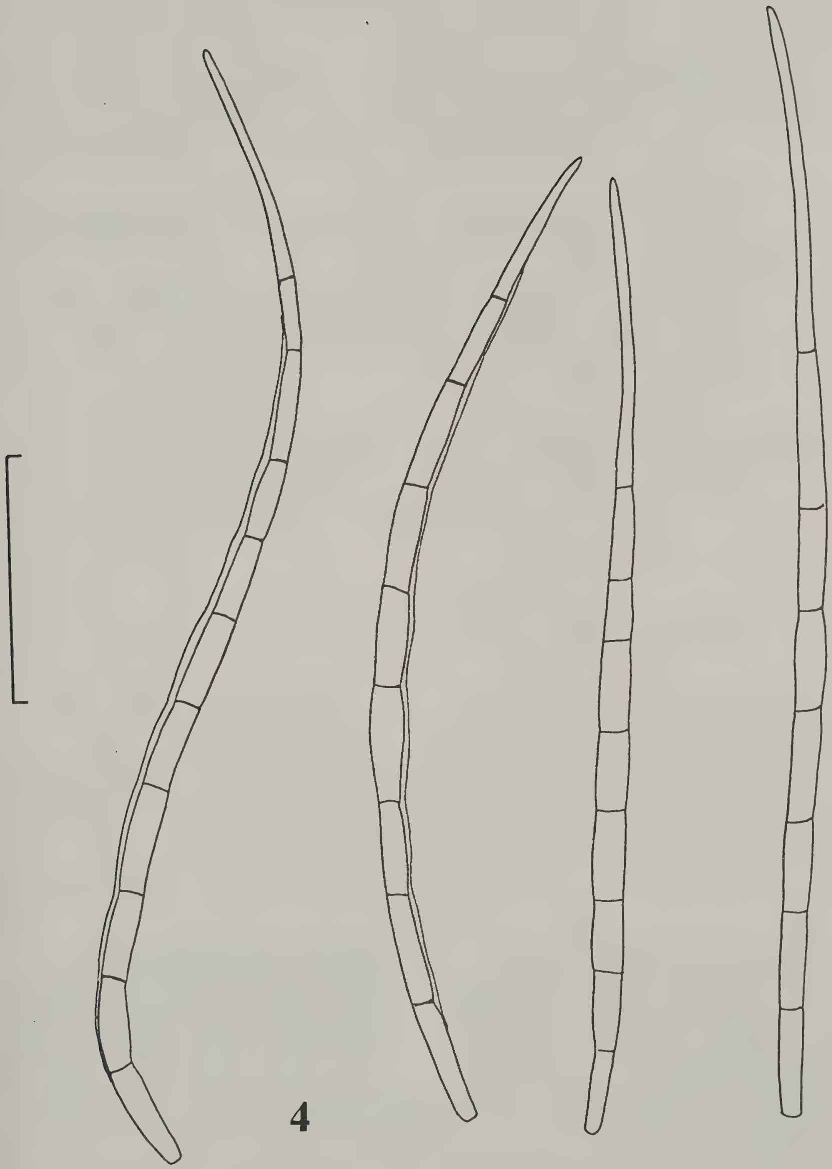


Fig. 4. *Cryptophiale pandanicola* (from holotye). Conidia. Scale bar: 10 µm.

Colonies effuse, hairy, greyish-black. *Mycelium* composed of immersed, branched, septate, brown, 3–4 µm wide hyphae. *Conidiophores* macronematous, mononematous, solitary, erect, unbranched, dark brown, smooth, thick-walled, multiseptate, base swollen, tapering to the fertile region, then slightly wider, before tapering to an acute rounded apex, up to 360 µm long, 8–10 µm wide just above the base, 6–8 µm wide below the fertile region. *Fertile region* on the upper half of conidiophore, 75–114 µm long, 16–24 µm wide, cylindrical, dark brown, septate, with conidiogenous cells all round and shielded by flat lobed pale brown cells; sterile apex 18–30 µm long, paler. *Conidia* hyaline, smooth, 7–10-septate, guttulate, elongate to nearly filiform, lower end truncate to rounded, upper end appendiculate, sometimes appearing unilaterally thickened and slightly constricted at the septa, 72–95 × 2·5–3 µm.

Typification: Mauritius, Petrin Reserve, on abaxial and adaxial surfaces of dead fallen leaf of *Pandanus barklyi*, 26 Aug. 1996, *R. Dulymamode* P150 (mycol. herb. Univ. Mauritius, holotype; IMI 380784, isotype).

Host species: *Pandanus barklyi.*

Distribution: Mauritius.

Species of *Cryptophiale* are primarily leaf litter fungi, although some have been found on rotten wood, and are of quite widespread distribution. Since the introduction of the name by Pirozynski (1968), twelve species have been described (Matsushima, 1971, 1975; Sutton & Hodges, 1976; Farr, 1980; Kuthubutheen & Sutton, 1985; Kuthubutheen, 1987; Sutton *et al.*, 1989; McKenzie, 1993; Goh & Hyde, 1996a). Species delimitation is mostly based on the features of the conidiophores and conidia and two groups can be recognized on the basis of conidiophore structure. The first group, comprising *C. cucullata* Kuthub., *C. guadalcanalensis* Matsush. and *C. udagawae* Piroz. & Ichinoe, produce conidiophores with branched apices and the second group, comprising the remaining species, with simple conidiophores.

Of the species accepted by Goh & Hyde (1996a), two produce multiseptate conidia reaching more than 50 µm in length. *Cryptophiale enormis* B. Sutton, Nawawi & Kuthub. is distinct because of its wide conidia. In *C. multiseptata* Goh & K.D. Hyde the conidia reach a maximal length of 62 µm and the tips are not appendiculate. *Cryptophiale pandanicola* is close to *C. multiseptata* in its gross morphological features but differs clearly in the size and septation of its conidia (72–95 × 2·5–3 µm and 7–10-septate compared to 30–62 × 2·5–4 µm and 3–8-septate, respectively).

Other material examined: Mauritius, Petrin Reserve, on abaxial and adaxial surfaces of dead fallen leaf of *Pandanus barklyi*, 8 Apr. 1996, *R. Dulymamode* P27b (mycol. herb. Univ. Mauritius).

Linodochium sideroxyli Dulymam., P.M. Kirk & Peerally, sp. nov.

Figs 5–6

Etymology: *sideroxyli*, in reference to the host genus.

Conidiomata sporodochia, superficialia, solitaria, circularis vel ovalis, gelatinosa, flava, 360–480 × 110–140 µm. *Mycelium* immersum. *Conidiophora* semi-macronemata, ramosa, septata, flavea vel hyalina, erecta, recta vel flexuosa. *Cellulae conidiogenae* 8–12 × 2–2·5 µm, discretae, terminales vel intercalares, hyalinae, tenuitunicatae, laeves. *Conidia* 32–48 × 1·5–2 µm, 2·5 µm lata ad apicem, hyalina, filiformes, laevia, tenuitunicata, 0–1-septata, guttulata.

Conidiomata sporodochial, circular to oval, superficial, solitary, dome-shaped above, gelatinous, yellow. *In vertical section* 360–480 µm wide, 110–140 µm high, pale orange in the centre, composed of *textura angularis*. *Mycelium* immersed. *Conidiophores* semi-macronematous, septate, branched, pale yellow to hyaline, erect, straight or flexuous, closely packed. *Conidiogenous cells* 8–12 × 2–2·5 µm, terminal or intercalary, discrete, integrated, thin and smooth-walled, hyaline, bearing 1–4 conidia. *Conidia* 32–48 × 1·5–2 µm, broader towards the apex reaching 2·5 µm, hyaline, smooth, long, needle-shaped, 0–1-septate, thin-walled, guttulate.

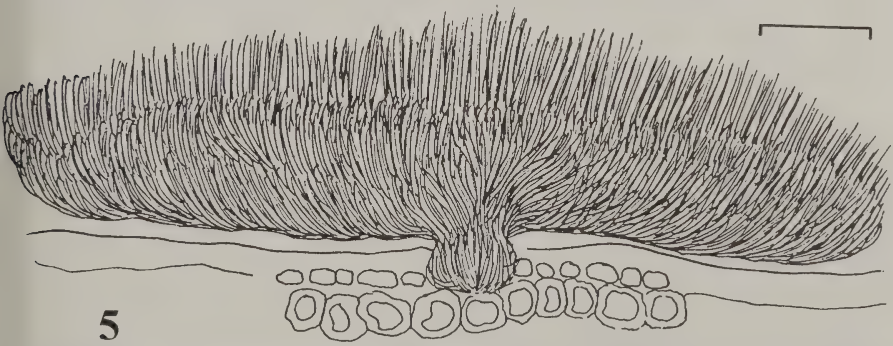


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Fig. 5. *Linodochium sideroxyli* (from holotye). Section of sporodochium. Scale bar: 50 µm.

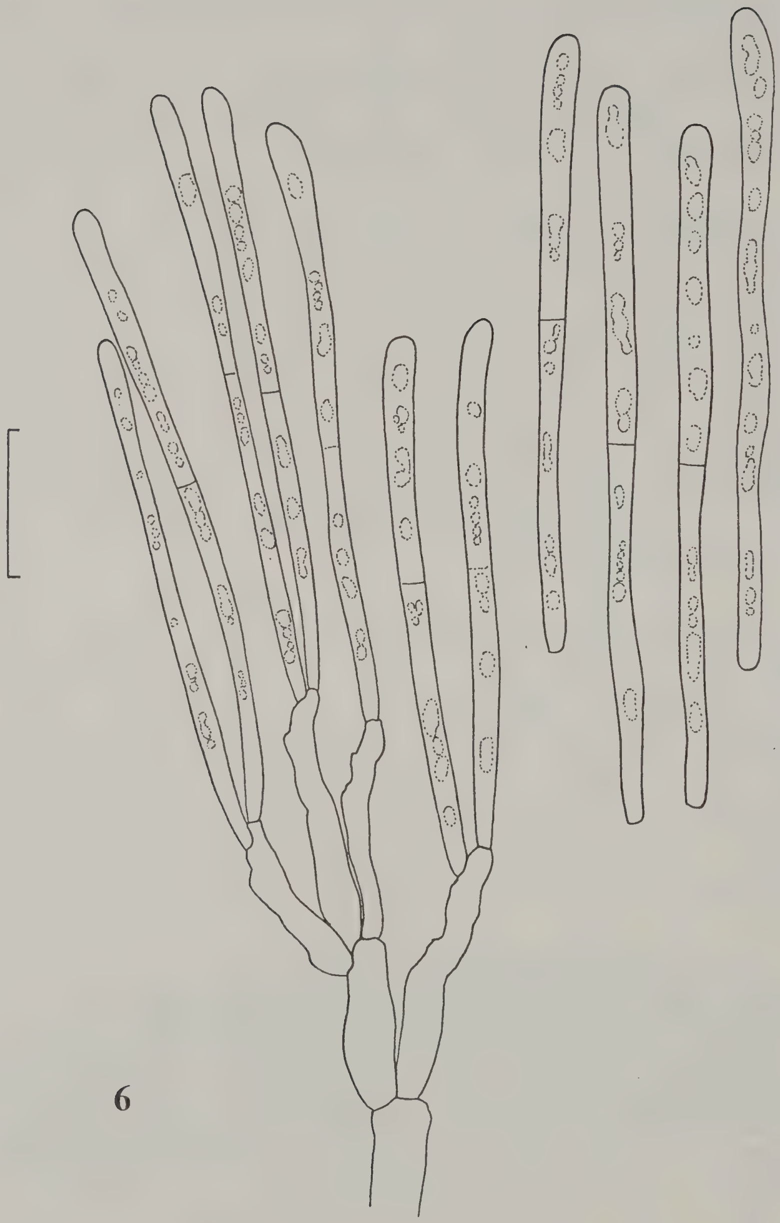

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Fig. 6. *Linodochium sideroxyli* (from holotye). Conidiophores, conidiogenous cells and conidia. Scale bar: 10 µm.

Typification: Mauritius, Petrin Reserve, on abaxial surface of dead fallen leaves of *Sideroxylon puberulum*, 8 Apr. 1996, *R. Dulymamode* S13 (mycol. herb. Univ. Mauritius, holotype; IMI 380783, isotype).

Host species: *Sideroxylon puberulum*.

Distribution: Mauritius.

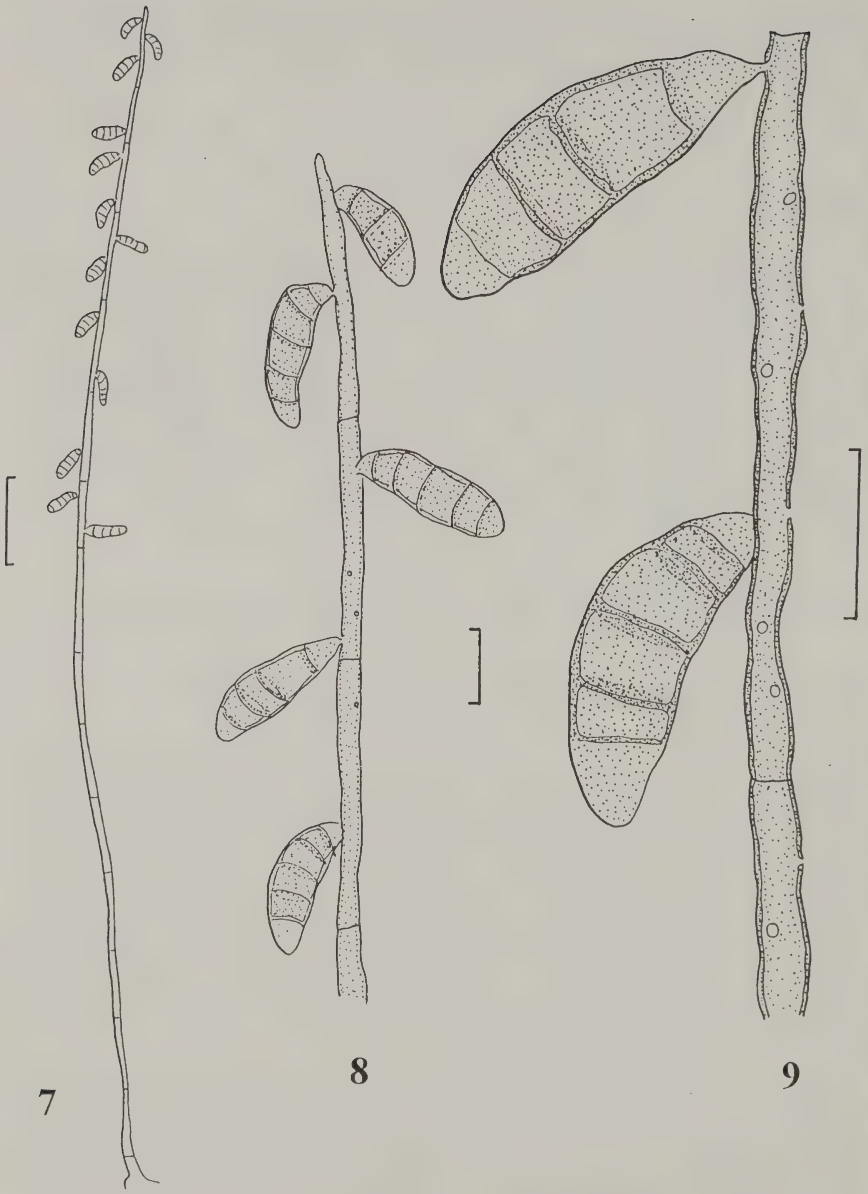
Two species of *Linodochium* are known; *L. hyalinum* (Lib.) Höhn. reported on *Pinus* needles from various European countries (Dyko & Sutton, 1979) has straight, hyaline, filiform, 2–4-septate conidia reaching 36–88·5 × 1–1·5 µm, and *L. formosum* Minter & Hol.-Jech. with conidia 0–12-septate and 80–140 × 2–3 µm (Minter & Holubová-Jechová, 1981). *Linodochium sideroxyli* differs from the two other species in its conidial sizes and morphology. Conidia are smaller in size at 32–48 × 1·5–2 µm and the conidial apex is broad as compared to acute in the other two species.

Spadicoides mauritiana Dulymam., P.M. Kirk & Peerally, sp. nov.
Figs 7–10

Etymology: *mauritiana*, in reference to the origin of the holotype.

Coloniae effusae, brunnae vel atro-brunnae, pilosae. *Mycelium* partim superficiale, partim in substrato immersum, ex hyphis pallide brunneis, laevis, ramosis, latis 2–3 µm compositum. *Conidophora* 550–815 × 3–4 µm, macronematosa, mononematosa, erecta, non-ramosa, recta vel curvata, laevia, septata, pallide brunnea. *Cellulae conidiogenae* 26–32 × 2·5–3·5 µm, polytreticae, terminales et intercalares, laevia, pallide brunnae, cum poris perforatae. *Conidia* 16–23 × 7–8 µm, acropleurogena, solitaria, pallide brunnea, laevia, crassitunicata, (4–) 5-septata, clavata vel obclavata, ad apicem rotundata, ad basim truncata.

Colonies effuse, brown to dark brown, hairy. *Mycelium* partly superficial and partly immersed, composed of pale brown to brown, branched, smooth, septate hyphae 2–3 µm wide. *Conidiophores* 550–815 × 3–4 µm, macronematous, mononematous, erect, simple, straight or flexuous, septate, unbranched, pale brown, smooth. *Conidiogenous cells* 26–32 × 2·5–3·5 µm, cylindrical, polytretic, terminal or intercalary, smooth, pale brown, perforated by minute pores. *Conidia* 16–23 × 7–8 µm, acropleurogenous, soiltary,



Figs 7–9. *Spadicoides mauritiana* (from holotye). 7. Conidiophore; 8. Conidiophore apex; 9. Conidiogenous cells and conidia. Scale bars: Fig. 7: 50 µm; Figs 8, 9: 10 µm.

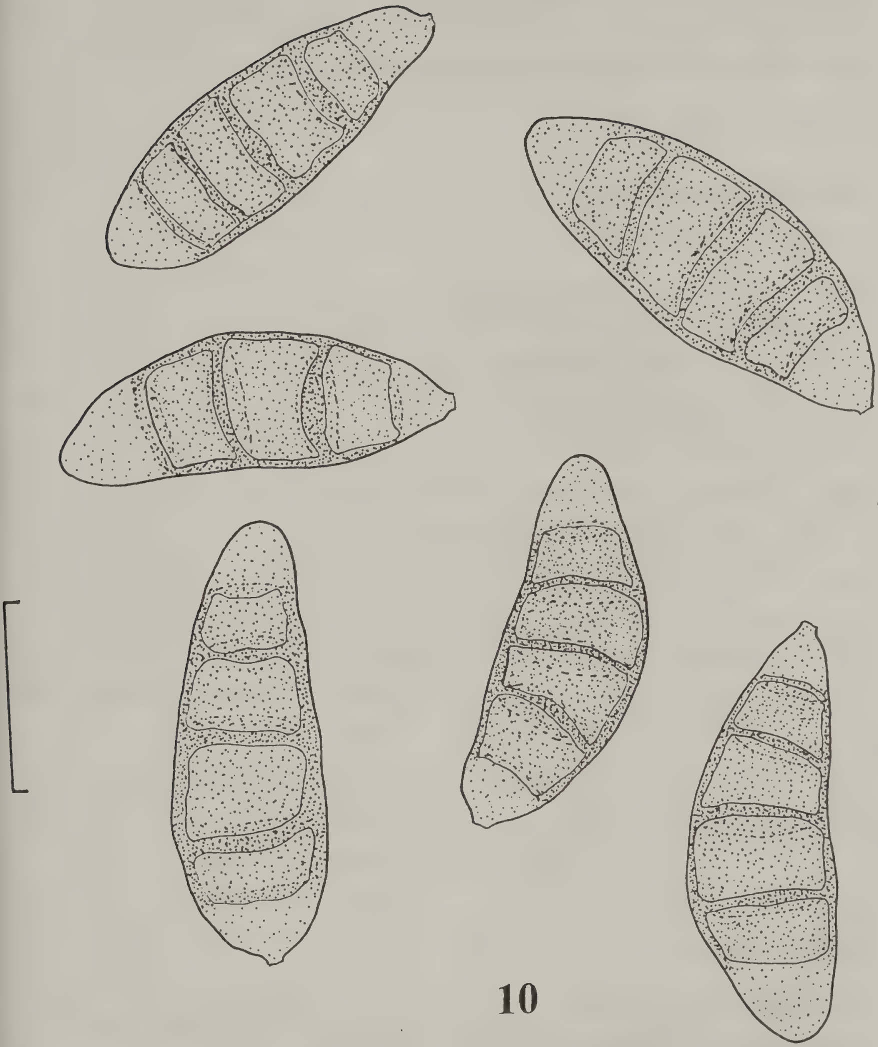


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Fig. 10. *Spadicoides mauritiana* (from holotye). Conidia. Scale bar: 10 µm.

thick-walled, smooth, pale brown, darker at the septa, (4–) 5-septate, clavate or obclavate, straight to slightly curved, apex rounded, base narrow and truncate.

Typification: Mauritius, Petrin Reserve, outside fence, on adaxial surface of dead fallen leaves of *Pandanus barklyi*, 14 Oct. 1996, *R. Dulymamode* P134 (mycol. herb. Univ. Mauritius, holotype; IMI 380782, isotype).

Host plant: *Pandanus barklyi*.

Known distribution: Mauritius.

Out of twenty-three species described in *Spadicoides*, sixteen were retained in the genus by Kuthubutheen & Nawawi (1991), six were transferred to *Diplococcium* (Holubová-Jechová, 1982; Sinclair *et al*., 1985) and one transferred to *Hemicorynespora* (Ellis, 1972). Goh & Hyde (1996b) recognized twenty-one species and provided a key for their identification and comparative illustrations of their conidia. *Spadicoides mauritiana* displays typical features of *Spadicoides*; unbranched, septate conidiophores bearing terminal and intercalary, cylindrical, polytretic conidiogenous cells producing clavate to obclavate, septate conidia. It appears to be close to *S. afzeliae* M.B. Ellis (Ellis, 1965) in conidial dimensions and septation. However, it is easily distinguished by its distinct clavate, smooth-walled conidia compared to the ellipsoid, rough-walled conidia of *S. afzeliae*. It is also close to *S. xylogena* (A.L. Sm.) S. Hughes but here the conidia are usually 3-septate and distinctly broader.

Other material examined: Mauritius, Petrin Reserve, outside fence, on adaxial surface of dead fallen leaves of *Pandanus barklyi*, 14 Oct. 1996, *R. Dulymamode* P138b (mycol. herb. Univ. Mauritius).

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References

DYKO, B.J. & SUTTON, B.C. (1979). A revision of *Linodochium*, *Pseudocenangium*, *Septopatella* and *Siroscyphella*. *Canadian Journal of Botany* **57**, 370–385.

Ellis, M.B. (1965). Dematiaceous Hyphomycetes. VI. *Mycological Papers* **103**, 1–46.

Ellis, M.B. (1972). Dematiaceous Hyphomycetes. XI. *Mycological Papers* **131**, 1–25.

Farr, M.L. (1980) A new species of *Cryptophiale* from Amazonas. *Mycotaxon* **11**, 177–181.

Goh, T.K. & Hyde, K.D. (1996a). *Cryptophiale multiseptata*, sp. nov. from submerged wood in Australia, and keys to the genus. *Mycological Research* **100**, 999–1104.

Goh, T.K. & Hyde, K.D. (1996b). *Spadicoides cordanoides* sp. nov., a new dematiaceous hyphomycete from submerged wood in Australia, with a taxonomic review of the genus. *Mycologia* **88**, 1022–1031.

Holubová-Jechová, V. (1982). Lignicolous hyphomycetes from Czechoslovakia. 6. *Spadicoides* and *Diplococcium*. *Folia Geobotanica et Phytotaxonomica Praha* **17**, 295-327.

Kuthubutheen, A.J. (1987). Another new species of *Cryptophiale* from Malaysia. *Transactions of the British Mycological Society* **89**, 274–278.

Kuthubutheen, A.J. & Nawawi, A. (1991). Two new sepcies of *Spadicoides* from Malaysia. *Mycological Research* **95**, 163-168.

Kuthubutheen, A.J. & Sutton, B.C. (1985). *Cryptophiale* from Malaysia. *Transactions of the British Mycological Society* **84**, 303–306.

Matsushima, T. (1971). *Microfungi of the Solomon Islands and Papua New Guinea*. Kobe, Japan: Published by the author.

Matsushima, T.(1975). *Icones microfungorum a Matsushima lectorum*. Kobe, Japan: Published by the author.

McKenzie, E.H.C. (1993). New hyphomycete species from litter in the Chatham Islands, New Zealand. *Mycotaxon* **46**, 291–297.

Minter, D.W. & Holubová-Jechová, V. (1981). New or interesting Hyphomycetes on decaying pine litter from Czechoslovakia. *Folia Geobotanica et Phytotaxonomica*. **16**, 195–217.

Pirozynski, K.A. (1968). *Cryptophiale*, a new genus of Hyphomycetes. *Canadian Journal of Botany* **46**, 1123–1127.

Sinclair, R.C., Eicker, A. & Bhat, D.J. (1985). Branching in *Spadicoides*. *Transactions of the British Mycological Society* **85**, 736–738.

Sutton, B.C. & Hodges, C.S. (1976). *Eucalyptus* microfungi: some setose hyphomycetes with phialides. *Nova Hedwigia* **27**, 343–352.

Sutton, B.C., Nawawi, A. & Kuthubuteen, A.J. (1989). Additions to *Belemnospora* and *Cryptophiale* from Malaysia. *Mycological Research* **92**, 354–358.

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NOTES ON THE GENUS FAYODIA S. L. (TRICHOLOMATACEAE) – I. TYPE STUDIES OF EUROPEAN MYXOMPHALIA SPECIES

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Abstract

The type studies of all European taxa of the genus *Myxomphalia* (Tricholomataceae) is given. On the basis of these studies and studies of the additional material, *Myxomphalia maura*, *M. invita* and *M. marthae* are considered identical; *M. agloea* (known from the type locality only) represents a separate species. The new combination *Myxomphalia agloea* (Sing. & Passauer) Antonín is proposed.

Key words: *Myxomphalia, Fayodia, M. maura, M. maura* f. *alba, M. invita, M. agloea, M. marthae*, type revision, Europe

The small genus *Myxomphalia* Hora (Trans. Br. mycol. Soc. 43: 453. 1960) is characterized by omphalioid or clitocyboid carpophores with umbilicate, striate, hygrophanous, smooth pileus, adnato-decurrent lamellae, more or less concolorous stipe with pileus, thick-walled in light microscope, amyloid spores, presence of cheilocystidia and pleurocystidia, always gelatinized pileipellis and stipitipellis, neither amyloid nor dextrinoid hyphae, and present clamp-connections. It is very close to *Fayodia* Kühner s. str. and *Gamundia* Raitelh. *Fayodia* differs in having round spores with wall of two layers (non-amyloid epispore and amyloid perispore), 2-spored basidia, absence of pleurocystidia and non-gelatinized hyphae, *Gamundia* has ellipsoid, thin-walled, non-amyloid, minutely ornamented spores.

For the first time, the taxon *Myxomphalia* was proposed by Kühner (1938) as a part of *Spuriae* of the genus *Mycena* with the only *M. maura*. However, this name has been published invalidly, without a Latin diagnosis. Bigelow (1959) raised it to the generic level for the first time. However, his combination was based on an invalid Kühner's publication, and, therefore, it is also invalid (Art. 33.2). The generic name *Myxomphalia* was validly published by Hora (1960) for the first time. Singer (1986) considered it a subgenus of *Fayodia*. Also Knudsen (1992) kept a broad concept of the genus *Fayodia*. On the contrary, Kuyper (1995) considers *Myxomphalia*, *Fayodia*, and *Gamundia* separate genera.

Weholt (1988) published a detailed study of European taxa. He revised type specimens of *Myxomphalia invita, M. marthae*, and *M. agloea* and compared them with recent nordic collections of *M. maura*. He considered all four described taxa conspecific (see notes below). Bon (1997) distinguishes four taxa in the genus *Myxomphalia* at various taxonomic levels – *M. maura, M. marthae* and *M. agloea* (as independent species), and *M. invita* (as a variety of *M. maura*). However, he did not revise the type specimens.

In this paper, I summarized my results of the revisions of all taxa described in the genus *Myxomphalia* or moved to it by the new combination.

Microscopical features are described from material mounted in Melzer's reagent, Congo-red, and KOH. For the basidiospores the following factors are used: X (average of spore size), E (quotient of length and width in all spores); Q (mean of E-values).

AGLOEA

`*Fayodia agloea* Singer & Passauer, Sydowia 32: 299. 1979.`

Type: Austria, Upper Austria (Oberösterreich), Aurach am Hongar near Vöklabruck, cave No. 2, 460 m alt., 2. V. 1976 leg. O. Moog (W, holotype of *Fayodia agloea*).

Selected icones: Singer & Passauer, Sydowia, 32: 301. 1979.
Selected literature: Bon, Doc. mycol. Mém. hors sér. 4: 164. 1997; Singer & Passauer, Sydowia, 32: 301. 1979; Weholt, Agarica 9(17): 71-101. 1988.

Description: Pileus up to 12 mm broad, convex with involute margin when young, umbonate at centre, translucently striate when wet, smooth or indistinctly striate at margin during drying where very small innate fibrills are present, but glabrous, non-viscid, hygrophanous, grey-brown, dirty grey-brown, slightly dry (when fresh) whitish grey, dry ash-grey to dirty grey-brown („brown sugar“, Maerz & Paul), drying from centre where remains whitish. Lamellae decurrent, white. Stipe 40 x 1.5-2 mm, cylindrical, pruinose at apex, dirty brown. Smell pleasant, taste mild. (Singer & Passauer 1979; a translation from German)

Type revision: Spores 5.0-6.0(-7.0) x 3.5-5.3 µm, X = 5.7 x 4.4 µm, E = 1.1-1.6, Q = 1.3, broadly ellipsoid, slightly thick-walled, ± smooth or indistinctly verruculose in a light microscope, amyloid, hyaline in KOH. Basidia 4-spored. Basidioles 15-23(-25) x 4.0-7.0 µm, clavate, cylindrical to subutriform. Hyphae of cylindrical to ellipsoid cells, which are thin-walled, smooth to minutely incrusted, non-dextrinoid, hyaline to subhyaline in KOH, up to 10.0(-15) µm wide. Cheilocystidia numerous, 22-48 x 9.0-15 µm, fusoid to subfusoid, often rostrate or with an apical pimple, rarely clavate, ± thin-walled, hyaline in KOH. Pleurocystidia similar. Pileipellis an (ixo)cutis, made up of radially arranged, parallel to slightly interwoven, cylindrical, ± thin-walled, slightly gelatinized to non-gelatinized, up 2-5 µm wide hyphae, with appressed to suberect, simple to coralloid lateral projections or terminal cells. Subpileipellis hyphae of cylindrical to ellipsoid cells, which are thin-walled smooth, rarely minutely incrusted, up to 20 µm wide cells. Stipitipellis an (ixo)cutis, of ± parallel , thin- to slightly thick-walled, slightly gelatinized or non-gelatinized, 2-5 µm wide hyphae. Caulocystidia (apex) cylindrical, clavate, fusoid, often rostrate, ± thin-walled. Clamp-connections present.

Notes: According to the type revision, *M. agloea* is characterized in having only slightly gelatinized or non-gelatinized pilei- and stipitipellis and mostly fusoid to subfusoid, often rostrate cystidia. In addition, spores are slightly smaller than in previous species (we have to measure more spores). Other macro- and microfeatures fit in variability of common *M. maura* (see below). Moreover, this species (only one carpophore!) has been found only once in a quite for fungi untypical habitat (in a distant part of a cave with a measured light 0.35 Lux). Weholt (1988) compared all taxa described in *Myxomphalia*, and considered *M. agloea* to be identical with *M. maura*. My studies of the type specimen showed that some microfeatures, especially cystidia, gelatinization and a spore wall surface in a SEM photomicrograph (see notes below), are different from *M. maura*. Therefore, I consider it a separate species representing an intermediate link between *Myxomphalia* and *Fayodia* s. l..

Myxomphalia agloea **(Singer & Passauer) Antonín comb. nov.**
Basionym: *Fayodia agloea* Singer & Passauer, Sydowia 32: 299. 1979.

INVITA
Agaricus invitus P. Karst., Bidr. Känn. Finl. Nat. Folk 25: 89. 1876; *Omphalia invita* (P. Karst.) P. Karst., Ryssl., Finl. Skand. Halföns Hattsvamp.: 127. 1879; *Omphalia maura* var. *invita* (P. Karst.) Cejp, Atlas hub evrop. 4: 83. 1936; *Fayodia invita* (P. Karst.) Singer, Ann. mycol. 41: 62. 1943; *Myxomphalia invita* (P. Karst.) M. Moser, Röhrlinge-Blätterpilze, Ed. 4: 186. 1978; *Myxomphalia maura* var. *invita* (P. Karst.) Bon ad int., Doc. mycol. Mém. hors sér. 4: 163. 1997.

Type: Finland, Tavastia australis, Tammela, Mustiala, sine dato, leg. P. A. Karsten (H, herb. Karsten 1591, holotype of *Agaricus invitus*).

Icones: none
Selected literature: Bon, Doc. mycol. Mém. hors sér. 4: 163. 1997; Weholt, Agarica 9(17): 71-101. 1988.

Description: Pileus submembranaceus, convex, umbilicate, glabrous, striate, fuligineous or blue-grey(lividus)-fuligineous when wet, blue-grey or pale grey when dry. Stipe stuffed, thin, cylindrical, straight, glabrous, white pruinose at apex, concolorous. Lamellae adnate, with decurrrent teeth, rather close, very broad, flat, white. Single or subcespitose, without smell. Pileus 1.5-3 cm broad. Stipe 2.5 cm long, c. 2 mm thick. Lamellae semicircular, to 5 mm broad. (Karsten 1876; a translation from Latin)

Type revision: Spores 5.5-7.0 x 4.0-5.0 µm, X = 6.3 x 4.3 µm, E = 1.2-1.6, Q = 1.5, broadly ellipsoid to ellipsoid, slightly thick-walled, amyloid, ± smooth in a light microscope. Basidia 17-23 x 6.0-7.5 µm, 4-spored, clavate, sometimes subutriform. Basidioles 10-22 x 4.0-7.5 µm, clavate, ± broadly clavate or subutriform. Cheilocystidia 30-65(-81) x 9.0-16 µm, clavate, subcylindrical, utriform, sublageniform, subfusoid, obtuse, ± thin-walled, hyaline in KOH. Pleurocystidia similar. Hyphae of cylindrical to ellipsoid, ± thin-walled, smooth, sometimes indistinctly incrusted, slightly gelatinized in subhymenium, pale yellowish-greyish in KOH, up to 25 µm wide cells. Pileipellis an ixocutis, made up of radially arranged, parallel to slightly interwoven, cylindrical, gelatinized, thin- to slightly thick-walled, up to 6 µm wide hyphae with lateral projections to cylindrical, digitate, obtuse, sometimes irregular to (sub)coralloid terminal cells. Subpileipellis hyphae smooth to indistinctly incrusted, pale yellowish-greyish in KOH. Stipitipellis an ixocutis, of ± parallel, cylindrical, ± slightly thick- to thin-walled, up to 6 µm wide hyphae with scattered lateral projections or terminal cells (caulocystidia). Clamp-connections present.

Additional specimens revised:
FINLAND: Tavastia australis, Tammela, Mustiala, 19. Oct. 1878 leg. P. A. Karsten (H, herb. Karsten 1594, as *Collybia invita*). – ditto, 21. Nov. 1878, leg. P. A. Karsten (H, herb. Karsten 1605, as *Omphalia invita*). – ditto, Nov. 1878 leg. P. A. Karsten (H, herb. Karsten 2033b, separated from *Collybia incomis*). - ditto, Oct. 1882 leg. P. A. Karsten. in: Thümen, Mycotheca universalis, No. 2101. (PRM 25330, as *Omphalia invita*).

Notes: *Agaricus invitus* P. Karst. (= *Myxomphalia invita*) was described from Finland. The revision of the type specimen and additional material collected by P. A. Karsten showed that it is completely identical with *M. maura*. In this case I agree with Weholt (1988) who considered both species identical.

MARTHAE

Fayodia marthae Singer & Clémençon, Schweiz. Z. Pilzk. 49: 122. 1971; *Myxomphalia marthae* (Singer & Clémençon) M. Moser, Röhrlinge-Blätterpilze, Ed. 4: 186. 1978.

Type: Italy, Valle d´Aosta (Savoy), Val Ferret, Frébouzie, 8. June 1971 leg. R. Singer (F C5383, holotype of *Fayodia marthae*).

Icones: none
Selected literature: Bon, Doc. mycol. Mém. hors sér. 4: 164. 1997; Singer & Clémençon (1971); Weholt, Agarica 9(17): 71-101. 1988.

Description: Pileus fuligineous, almost black, hygrophanous, with paler radial striation, ± lubricous, smooth, hemispherical-convex, with a deep abrupt umbilicus, 12-13 mm high, 20-34 mm broad. Lamellae pale grey or dirty grey, close, very broad (9 mm), adnate to with decurrrent teeth. Stipe dark umber-dirty brown, longitudinally paler striate, cylindrical or subcylindrical, stuffed, 18-20 x 2.5-4.5 mm, mycelium at base white. Context concolorous in pileus, stipe and lamellar trama, only in stipe medulla paler. Without smell. (Singer & Clémençon 1971; a translation from German)

Type revision: Spores 5.5-7.0 x (4.0-)4.5-6.0 µm, X = 6.5 x 4.9 µm, E = 1.1-1.6, Q = 1.4, ellipsoid to broadly ellipsoid, slightly thick-walled, smooth in a light microscope, amyloid, hyaline in KOH. Basidia 15-23 x 6.5-8.0 µm, 4-spored, clavate. Basidioles 10-18 x 4.0-8.0 µm, clavate, broadly clavate, (sub)cylindrical. Cheilocystidia (21-)31-68 x (5.0-)8.0-15 µm, clavate, subcylindrical, rarely lageniform, often irregular to almost lobate, ± thin-walled, hyaline in KOH and H_2O. Pleurocystidia similar. Hyphae cylindrical to ellipsoid, thin-walled, smooth, in mediostratum minutely incrusted, subhyaline to pale yellow in KOH, greyish-yellowish in H_2O, up to 20 µm wide. Pileipellis an ixocutis, made up of ± interwoven, gelatinized, thin- to slightly thick-walled, cylindrical, hyaline to pale brownish in KOH and H_2O, up to 7 µm wide hyphae, sometimes with lateral projections; terminal cells and lateral projections appressed to erect, mostly irregular to coralloid. Subpileipellis hyphae distinctly incrusted by dark grey-brown pigment in KOH and H_2O. Stipitipellis an ixocutis, of ± radially arranged, cylindrical, slightly thick-walled, gelatinized, pale yellowish to yellow-greyish in KOH, subhyaline in H_2O, up to 6 µm wide hyphae. Caulocystidia appressed to (sub)erect, 25-50 x 4.5-6.0(-10.0) µm, cylindrical to narrowly clavate, often irregular to submoniliform, thin- to slightly thick-walled. Clamp-connections present.

Notes: Singer & Clémençon (1971) described *Fayodia marthae* (= *Myxomphalia marthae*) as a new species, which should differ from *M. maura* and *M. invita* in having rather short stipe, very dark pileus and broad lamellae. However, these macroscopic features fit rather well in the variability of *M. maura*. In the type specimen revision I have found the only microscopical difference from *M. maura/invita* group - distinctly incrusted subpileipellis hyphae. However, this represents too small difference to distinguish it as a separate taxon. Therefore, I consider it identical with *M. maura*.

MAURA

Agaricus maurus Fr., Syst. mycol. 1:168. 1821; *Omphalia maura* (Fr.) Gillet, Hyménomycetes: 290. 1874; *Omphalina maura* (Fr.) Quél., Enchir. Fung.: 42. 1886; *Mycena maura* (Fr.) Kühner, Genre Mycena: 535. 1938 [non *Mycena maura* Maire 1928 = *M. floccipes*, see Kühner 1938]; *Fayodia maura* (Fr.) Singer, Ann. mycol. 34: 331. 1936; *Myxomphalia maura* (Fr.) H. E. Bigelow, Canad. J. Bot. 37: 777. 1959 (an invalid combination, Art 33); *Myxomphalia maura* (Fr.) Hora, Trans. Br. mycol. Soc. 43: 453. 1960.

Type: Upland, Upsala, Stadsskogen, near Kåbo, 5. X. 1957 leg. H. Belin, in: Lundell & Nannfeldt, Fungi exsiccati suecici, No. 2528. (PRM 515933, as *Omphalia maura,* neotype, selected here).

Selected icones: Bolets de Catalunya 9: pl. 429. 1990; Bon, Champ. Eur. occ.: 130. 1987; Breitenbach & Kränzlin, Pilze Schweiz 3: pl. 374. 1991; Cetto, Funghi Vero 4: pl. 1482. 1983; Dähncke, 1200 Pilze: 384, 385. 1993; Konrad & Maublanc Ic. sel. Fung. 3: pl. 234. 1932; J. Lange, Fl. Agar. dan. 2: pl. 59J. 1936; Michael, Hennig & Kreisel, Handbuch Pilzfr. 3, ed. 2: 128. 1977; Phillips, Mushr. other fungi: 69. 1981; Ryman & Holmåsen, Svampar: 367. 1984.

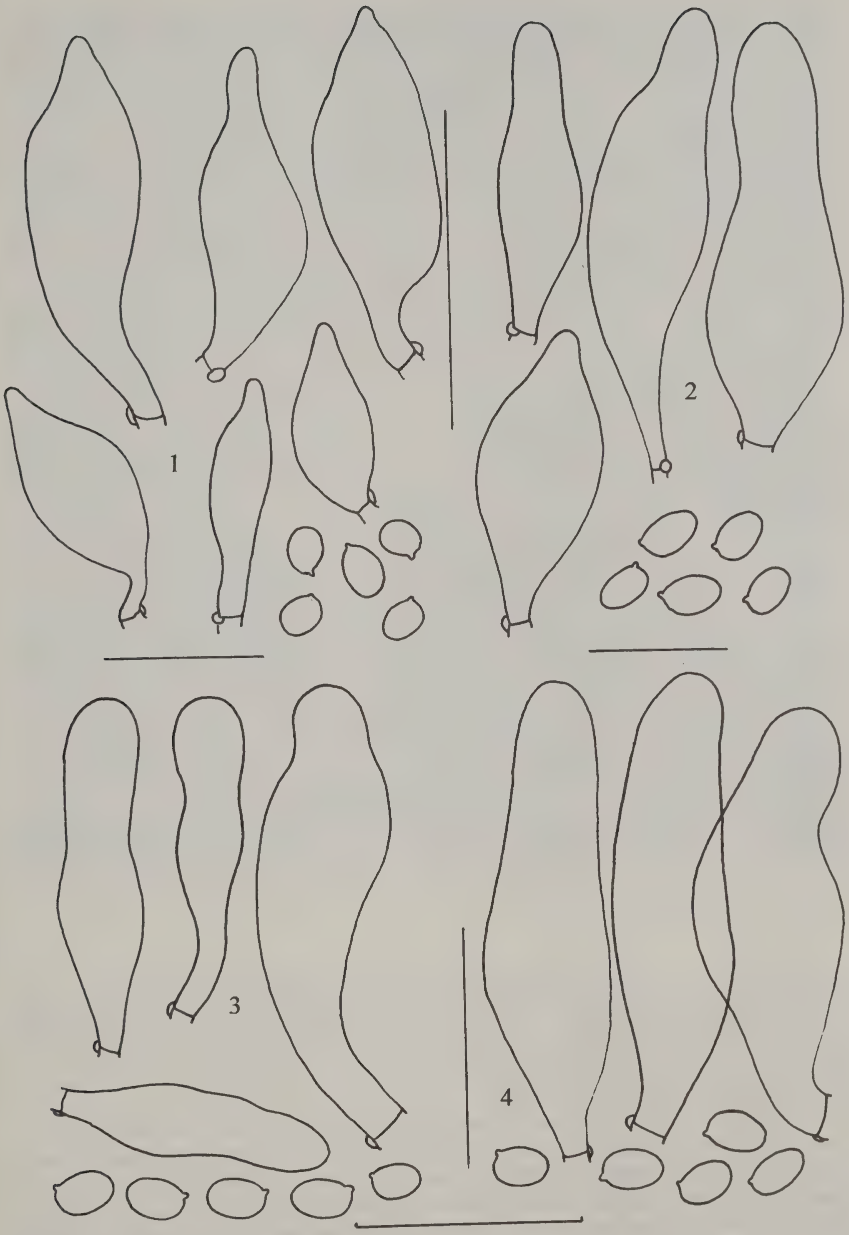
Selected literature: Bigelow, Beih. Nova Hedw. 51: 70. 1975; Bon, Doc. mycol. 23(91): 35-36. 1993; Bon, Doc. mycol. Mém. hors sér. 4: 163. 1997; Kuyper, Fl. agar. Neerland. 3: 156-157. 1995; Kühner, Mycena: 535-537. 1938; J. Lange, Dansk Bot. Arkiv 6(5): 8. 1930; Malençon & Bertault, Fl. Champ. sup. Maroc 2: 213-214. 1975; Weholt, Agarica 9(17): 71-101. 1988.

Description: Pileus 10-40 mm convex, distinctly umbilicate at centre, with involute margin, uneven when old, hygrophanous, at least up to 2/3 translucently striate, smooth, glabrous, apparently fibrillose when moist, grey, grey-brown to black-brown when moist, sometimes slightly paler at centre, palescent to pale grey-brown on drying.

Lamellae distinctly decurrent, moderately close, L = 20-29, l = 3, sometimes slightly undulate, broad, whitish to pale greyish, with concolorous, slightly pubescent edge. Stipe 18-45 x 1.5-3.0(-4.0) mm, cylindrical, slightly broadened above, slightly broadened to narrowly clavate at base (up to 5 mm), slightly flocculose at apex, slightly longitudinally striate, watery brown, dark brown to grey-brown (± concolorous with pileus colour or slightly darker), paler at apex. Context whitish. Smell farinaceous-spermatic. Taste mild. [macrodescription based on fresh collections (Drietoma-Liešna, 20. VI. 1998, Antonín 98.10 and Brno, 19. X. 1998, Barša)]

Neotype revision: Spores (5.5-)6.0-7.0 x (4.0-)4.2-5.0 µm, X = 6.2 x 4.5 µm, E = 1.2-1.6, Q = 1.4, broadly ellipsoid to ellipsoid, slightly thick-walled, smooth in a light microscope, amyloid, hyaline in KOH. Basidia 20-22 x 6.0-8.0 µm, 4-spored, clavate. Basidioles 14-22 x 4.0-7.5 µm, cylindrical to clavate. Cheilocystidia 31-90 x 12-21 µm, clavate, fusoid, utriform, sometimes slightly irregular, thin- to slightly thick-walled, pale yellowish-greyish in KOH. Pleurocystidia similar. Hyphae cylindrical, gelatinized, thin-walled, indistinctly incrusted to smooth in mediostratum, non-dextrinoid, 2-20 µm wide. Pileipellis an ixocutis, made up of radially arranged, ± thin-walled, gelatinized, smooth, non-dextrinoid, (sub)hyaline in KOH, 2-7 µm wide hyphae; sometimes sub-diverticulate or with digitate to subfiliform, irregular to coralloid, thin-walled lateral projections. Subpileipellis hyphae minutely incrusted, distinctly yellowish(-greyish) in KOH, up to 20 µm wide. Stipitipellis an ixocutis, of ± parallel, thin- to slightly thick-walled, gelatinized, non-dextrinoid, pale yellowish-greyish in KOH, 2-8 µm wide hyphae; medulla hyphae smooth to minutely incrusted. Caulocystidia scattered, in form of cylindrical, digitate, obtuse, irregular lateral projections. Clamp-connections present.

Additional specimens revised:
CZECH REPUBLIC: Špindlerův Mlýn, 8. IX. 1946 leg. J. Kubička (PRM 520864). – Pustá Seč near Jičína, 5. X. 1972 leg. E. Dlouhý (PRM 725189). – Hanov near Konstantinovy Lázně, 12. IX. 1972 leg. A. Pilát (PRM 718503). – Praha-Smíchov, 29. X. 1964 leg. E. Wichanský (PRM 605521). - Praha-Krč, X. 1933 leg. V. Sak (PRM 25331). – Praha, „Hvězda“, 19. X. 1945 leg. J. Herink (PRM 710170). – ditto, 31. X. 1934 leg. J. Herink (PRM 25335). – Praha, „Kinského sady“, 26. IX. 1964 leg. E. Wichanský (PRM 603946). – Praha-Veleslavín, 29. XI. 1942 leg. J. A. Herink (PRM 710174). – Říčany, 28. IX. 1941 leg. M. V. Svrček (PRM 710177). – ditto, 29. XI. 1942 leg. S. Havlena (PRM 710176). – ditto, XI. 1936 leg. A. Pilát (PRM 34514). - Jevany, 9. XI. 1947 leg. V. Vacek (PRM 515053). – Jirny, 10. XII. 1934 leg. V. Sak (PRM 25336). - Myšlín, X. 1939 leg. J. Velenovský (PRM 154558). – ditto, XI. 1938 leg. J. Velenovský (PRM 154521). – Průhonice near Praha, Arboretum, 15. V. 1950 leg. M. Svrček (PRM 717252). – Modřany, „Libušino údolí“, 13. X. 1968 leg. O. Dvořák (PRM 671826). – Trutnov, 8. IX. 1954 leg. F. Kotlaba (PRM 710181). – Skalka u Mníšku, 7. V. 1944 leg. I. Charvát (PRM 710167). – Čeřenice na Sáz., Poříčko, 14. V. 1944 leg. J. Kubička (PRM 710068). – Třeboň, Majdalena, „Sv. Barbora“, 1. IX. 1963 leg. J. Kubička (PRM 614882). – Šumava-Mts., Stožec, 28. VII. 1954 leg. K. Kříž (BRNM 313544). – Radešovice, X. 1933 leg. V. Sak (PRM 25332). – Novohradské hory-Mts., Leopoldov, „Vyhlídka“, 29. X. 1965 leg. M. Svrček and J. Kubička (PRM 610375). – Lipůvka, „Dubová hora“, 5. IX. 1963 leg. F. Šmarda (BRNM 313561). – Jihlava, „Čeřínek“, 11. IX. 1966 leg. F. Šmarda (BRNM 301694). – Lhotka near Žďár n. Sáz., 30. X. 1948 leg. F. Šmarda (BRNM 313545). – Nové Město na Mor., „Plačkovec“, 5. IX. 1963 leg. F. Šmarda (BRNM 313560). – Brno, 19. X. 1998 leg. A. Barša (BRNM). – Brno-Žebětín, „Rakovec“, near „Křivá borovice“, 30. X. 1996 leg. K. Koncerová (BRNM 301693). – Kuřim, „Babí lom“, 22. X. 1939 (BRNM 313546); ditto, „Kopaniny“, 17. VII. 1948 leg. F. Šmarda (BRNM 313543). – Jedlová near Polička, „Balda“, 12. IX. 1963 leg. F. Šmarda (BRNM 313559). – Nová Ves, 17. X. 1963 leg. J. Lazebníček and F. Valkoun (BRNM 313562). – Věžná

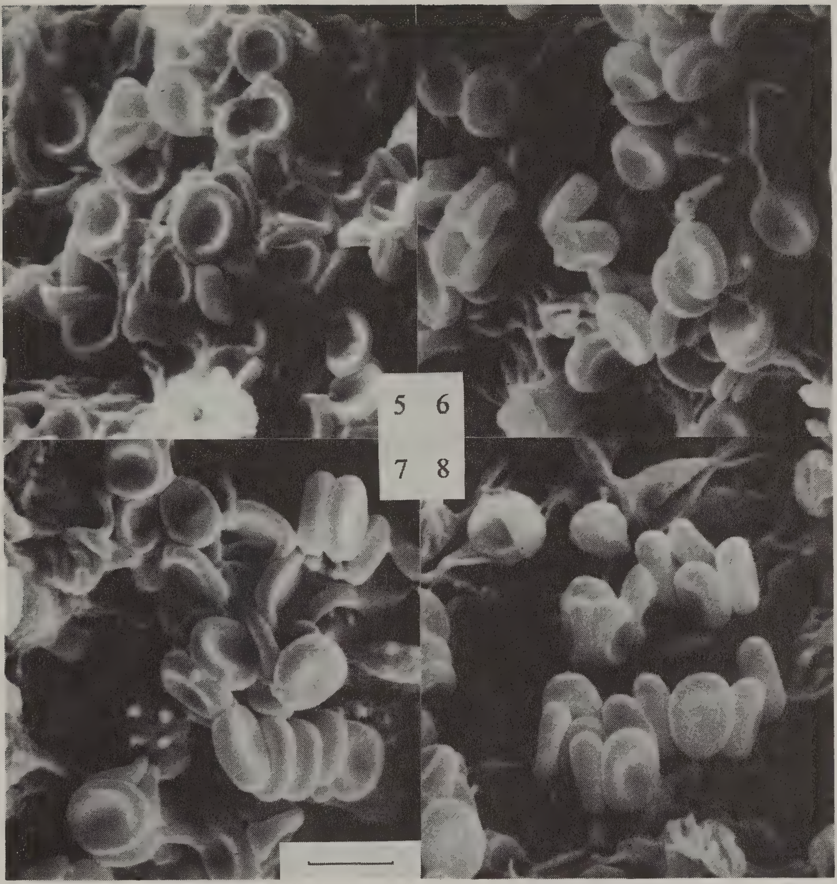


Figs. 1-4. *Myxomphalia* - cystidia and spores. 1. *M. agloea* (holotype, as *Fayodia a.*), 2. *M. invita* (holotype, as *Agaricus i.*), 3. *M. marthae* (holotype, as *Fayodia m.*), 4. *M. maura* (neotype, as *Omphalia m.*). Scale bar = 20 µm.

near Nedvědice, 28. X. 1944 leg. F. Šmarda (BRNM 313547). – M. Budíkov, „V Opálenici", 27. X. 1968 leg. A. Čábera (BRNM 313775).
POLAND: Karkonosze Mts., Wilcza Poreba near Karpacz (Wolfshau bei Krümmhübel), 13. VIII. 1922 leg. H. Sydow, in: Sydow, Mycotheca germąnica no. 1805 (PRM 710165 and 710180).
FINLAND: Oulun Pohjanmaa, Kiiminki, Jääli, 28. IX. 1989 leg. E. Ohenoja (O 120150).
GERMANY: Brandenburg, Prenden (Kreis Nieder-Barnim), 4. X. 1916 leg. P. Sydow, in: Sydow, Mycotheca germanica no. 1804 (PRM 710164 and 710179). – Görlitz, X. 1933 leg. A. Pilát (PRM 25333).
NORWAY: Akershus, Baerum, 15. IX. 1955 leg. F.-E. Eckblad (O 120138). – ditto, Lysakerelva, 20. IX. 1956 leg. F.-E. Eckblad (O 120126). – ditto, 1955 leg. F.-E. Eckblad (O 120124). - Akershus, Ski, 21. X. 1848 leg. ? (O 120147). – ditto, 15. IX. 1946 leg. G. Soot (O 120139). - Akershus, Nannestad, 13. IX. 1974 leg. G. Gulden 91/74 (O 120137). – ditto, Tømte, 20. IX. 1977 leg. G. Gulden 203/77 (O 120125). – Akershus, Eidsvoll, Dal, 9. X. 1984 leg. B. O. Olsen (O 120117). – ditto, 5. XI. 1986 leg. B. O. Olsen (O 120116). – ditto, 6. XI. 1986 leg. B. O. Olsen (O 120140). - Ackershus, Nes, Årnes, 23. IX. 1962 leg. G. Tansen (O 120133). – Buskerud, Nes, sine dato, leg. L. Ryvarden 34594 (O 70726). – Buskerud, Ringerike, V. Ådal, Høgfjell, 14. IX. 1974 leg. A.-E. Torkelsen 1066 and 1071/74 (O 120144 and 120143). – Oppland, Lillehammer, Römsåren, 28. IX. 1975 leg. M. Jenssen (O 120131). – Sør-Fron, 3. VIII. 1978 leg. J. Stordal 19219 (O sine num.). – Gausdal, 11. VI. 1974 leg. L. Ryvarden 13002 (O 120132). – Vest-Agder, Farsund, 8. X. 1978 leg. A. Pedersen and K. Høiland (O 120142). – Vestfold, Tønsberg, 13. X. 1981 leg. A. Aronsen (O 120148). – ditto, 2. X. 1978 leg. P. Marstad (O 120146). – ditto, Sem, Eik, 9. X. 1978 leg. P. Marstad (O 120145). - Vestfold, Nøtterøy, Veierland, 15. X. 1982 leg. S. Aase (O 120149). – ditto, 9. X. 1977 leg. I. Egeland (O 120141). – Oslo, Tryvath and Nordmarka, 2. X. 1977 leg. K. Høiland (O 120128). – ditto, Brannfjell, 20. X. 1963 leg. E. Hveem (O 120129). – ditto, Bygdö, X. 1916 leg. J. Egeland (O 120134). – ditto, Østmarka, Skullerud, 30. X. 1966 leg. S. Sivertsen (O 120127). – ditto, 24. IX. 1974 leg. I. Egeland (O 120130). – Østfold, Tune, Sarpsborg, 6. X. 1974 leg. G. Gulden (O 120136). – Østfold, Fredrikstad, 27. X. 1984 leg. Ø. Weholt (O 120123).
SLOVAKIA: Biele Karpaty Mts., Drietoma-Liešna, „Machnač", 20. VI. 1998 leg. V. Antonín 98.10 (BRNM). – Poprad, Kvetnica, „Križová", 900 m, 31. V. 1946 leg. J. Kubička (PRM 521306). – ditto, 22. V. 1946 leg. J. Kubička (PRM 521308).
SWEDEN: Småland, Femsjö parish, „Haggårds tomter", 15. IX. 1940 leg. S. Lundell, in: Lundell & Nannfeldt, Fungi exsiccati suecici, No. 1115. (PRM 710168). – Uppland, Ärentuna parish, Storvreta, E. outskirts, 27. X. 1974 leg. N. Lundqvist 9601, in: Lundell & Nannfeldt, Fungi exsiccati suecici, No. 2907. (PRM 821476). – Uppland, Uppsala, Stadsskogen, 6. XI. 1949 leg. J. Stordal 3244 (O 120135).

Notes: *Myxomphalia maura* represents a rather common species characterized in having rather dark grey, brown-grey to black-brown pileus, decurrent lamellae, slightly thick-walled amyloid spores and distinctly gelatinized pilei- and stipitipellis; it often grows on fireplaces. It is not distinguishable from *M. marthae* and *M. invita* (see notes above). In this point I agree with Weholt (1998).

Kühner described (in Vandendries, Compt. Rend. Acad. Sci. 204: 1084. 1937; an invalid publication, without a Latin diagnosis, Art. 36.1) f. *alba* having totally white carpophores. Unfortunately, his specimen was not traced in the Kühner's herbarium in Geneva (Clerc in litt.). The white coloured carpophores were also collected by Malençon & Bertault (1975) in Morocco. However, I have not received that material from the herbarium MPU for my studies.



Figs. 5-8. *Myxomphalia* - SEM photomicrographs of spores: 5. *M. agloea* (holotype), 6. *M. invita* (holotype), 7. *M. marthae* (holotype), 8. *M. maura*. Scale bar = 5 µm. (TESLA BS 300 SEM)

Notes to spore wall surface of *Myxomphalia* species

The spore wall surface is described as being either always smooth, e.g. by Bon (1997), Breitenbach & Kränzlin (1991), Kuyper (1995), or smooth to with scattered verruculae, e. g. Hora (1960), Kühner (1938), Kühner & Romagnesi (1953), Pegler & Young (1971). The spore wall of all revised *Myxomphalia* specimens was (almost) smooth in a light microscope.

Concerning the spore surface in the SEM photomicrographs, Bigelow (1979) showed totally smooth spores in the North American collections. In the European species (figs. 5-8.), *Myxomphalia invita*, *M. marthae* and *M. maura* have smooth spores, while *M. agloea* minutely verruculose ones. However, its spores agreed with *Myxomphalia* in other aspects (amyloid, thick-walled). Therefore, I consider *M. agloea* a transient taxon between *Myxomphalia* and *Fayodia/Gamundia* group.

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I wish to thank the curators of the herbaria F, H, O, PRM, and W for a kind sending the type and other collections, Mr. Jiří Lhotecký (Brno, Czech Republic) who kindly provided SEM photomicrographs, and Dr. Pavel Lizoň (Bratislava, Slovak Republic) for correcting my English manuscript. This study represents a partial result of a larger taxonomic project enabled by a grant from the Grant Agency of the Czech Republic no. 206/98/0257.

REFERENCES

Bigelow H. E. (1959): Notes on fungi from northern Canada. IV. Tricholomataceae. – Canad. J. Bot. 37: 769-779.
Bigelow H. E. (1979): Notes on Fayodia ss. lato. – Mycotaxon 9(1): 38-47.
Bon M. (1993): Myxomphalia maura (Fr.: Fr.) Hora. – Doc. mycol. 23(91): 35-36.
Bon M. (1997): Clitocybes, omphales et ressemblants. – Fl. mycol. Eur. 4, Doc. mycol. Mém. hors sér. 4: 1-181.
Breitenbach J. & Kränzlin F. (1991): Fungi of Switzerland. Vol. 3. Boletes and Agarics. 1st part. – Luzern.
Fries E. M. (1981): Systema mycologicum. Vol. 1. – Gryphiswaldiae.
Hora F. B. (1960): New check-list of British Agarics and Boleti. Part. IV. Validations, new species and critical notes. – Tr. Brit. mycol. Soc. 43(2): 440-459.
Knudsen H. (1992): Fayodia. – in: Hansen L. & Knudsen H. (eds.), Nordic Macromycetes, Vol. 2. Polyporales, Boletales, Agaricales, Russulales, Copenhagen, p. 121-122.
Kühner R. (1938): Le genre Mycena (Fries). – Encyclopédie Mycologique 10: 1-710. Paris.
Kühner R. & Romagnesi H. (1953): Flore analytique des champignons supérieurs. – Paris.
Kuyper T. W. (1995): Myxomphalia Hora. – In: Bas C. & al. (eds.), Flora Agar. Neerland., Vol. 3, p.156-157.
Lange J. E. (1930): Studies in the Agarics of Denmark. Part VIII. Omphalia, Pleurotus, Clitocybe. – Dansk Bot. Arkiv 6(5):1-64.
Malençon G. & Bertault R. (1975): Flore des chapignons superieurs du Maroc. Vol. II. – Trav. Inst. Scient. Cherif. Fac. Sci. Rabat, 33: 1-540.
Pegler D. N. & Young T. W. K. (1971): Basidiospore morphology in the Agaricales. – Beih. Nova Hedw. 35: 1-210.
Singer R. (1943): Das System der Agaricales. III. – Ann. Mycol. 41: 1-189.
Singer R. (1986): The Agaricales in modern taxonomy. Ed. 4. – Koenigstein.
Singer R. & Clémençon H. (1971): Neue Arten von Agaricales. – Schw. Zeitschr. Pilzk. 49: 118-128.
Singer R. & Passauer U. (1979): Höhlenbewohnende Agaricales. – Sydowia 32: 299-304.
Smith A. H. (1949): Mushrooms in their natural habitats. – Portland.
Weholt O. (1988): A study of Myxomphalia with relation to European species and collects of Myxomphalia Hora found in Norwegian herbaria. – Agarica 9(17): 71-101.

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THE LICHEN FAMILY PHYSCIACEAE (ASCOMYCOTA) IN CHINA Ⅰ. THE GENUS ANAPTYCHIA

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Abstract

Six species of *Anaptychia* in China are recognized. They are *A. ciliaris* (L.) Körb., *A.ethiopica* Swinsc. & Krog, *A. isidiza* Kurok., *A. palmulata* (Michx.) Vain., *A. setifera* Räs., and *A.ulotrichoides* (Vain.) Vain. Among them *A. ethiopica* and *A.setifera* are recorded in China for the first time. *A. runcinata* (With.) Laundon is excluded from the Chinese lichen flora. Key to Chinese species of *Anaptychia* and Chinese distribution of *Anaptychia* are provided.

Introduction

Kurokawa (1973) recorded 88 species of *Anaptychia* (s.lat.) in the world, of which 79 species belong to *Heterodermia* Trev. emend Poelt, and 9 species belong to *Anaptychia* Körb. emend Poelt. After 1973 some new species and new combinations of *Anaptychia* were reported, e.g. *A. ethiopica* Swinscow & Krog (1976), *A. pseudoroemeri* Awasthi & S.Singh (1978)), and *A. mamilata* (Tayl.) Hawksworth (1973). About 12 species of *Anaptychia* are known at the present in the world.

Eight species of *Anaptychia* from China were reported by lichenologists (Wei, 1991). They are *A. ciliaris* (L.) Körb., *A. runcinata* (With.) Laundon (Syn.: *A. fusca* (Hunds.) Vain.), *A. pacifica* Kurok., *A. palmulata* (Michx.) Vain., *A. tentaculata* (Zahlbr.) Kurok., *A. isidiza*

Kurok., *A. ulotrichoides* (Vain.) Vain., and *A. wrightii* (Tuck.) Zahlbr. However, *A. tentaculata* belongs to *Physconia* (Poelt, 1966; Kurokawa, 1973), *A. pacifica* should belong to *Heterodermia* according to original descriptions of Kurokawa (1973), and *A. wrightii* (Tuck.) Zahlbr. does not belong to the Physciaceae but refers to *Physcidia wrightii* (Kurokawa, 1960; Wei, 1991).

We have studied and reexamined over 300 specimens from China, which are deposited in HMAS-L and FPI. Lichen substances were determined with TLC method. The present study shows that *Anaptychia* in China includes following 6 species: *A. ciliaris, A. ethiopica, A. setifera* (Syn.: *A. kaspica*), *A.isidiza, A. palmulata*, and *A. ulotrichoides. A. fusca* (=*A. runcinata*) reported by Zhao *et al.* (1982) is excluded from the Chinese lichen flora. The so-called "*A. wrightii*" from China reported by Zhao *et al.* (1982) is in fact *Heterdermia diademata.*

Chinese species of *Anaptychia*

1. *Anaptychia ciliaris* (L.) Kőrb.

In Mass. Mem. Lichenogr. 35. 1853. —*Lichen ciliaris* L. Sp. Pl. **2**: 1144. 1753.

This species is characterized by the thallus composed of linear-elongate lobes; lobes often more than 2mm wide, pubescent on the upper surface, and subascending to the apices; the lower surface decorticate and irregularly veined; rhizines simple or sometimes branched towards the apices, pubescent; lacking lichen substances (with TLC).

Kurokawa (1962) recognized four forms in *A. ciliaris*, which were separated mainly by the width of lobes, the abundance of pycnidia, and colors of the verrucae. However, these characters may produced by ecological conditions don't seem to have any taxonomic value. Therefore the four forms were simply reduced as synonyms of *A. ciliaris* by Kurokawa (1973).

Representative specimens examined: **Xinjiang**, Mt. Tianshan, alt. 2500-2600m, K. M. Liou 3582, 6784; X. Y. Wang 1211. **Gansu**, Sunan couty, C. F. Zhao 2676.

Shaanxi, Mt. Huashan, alt. 1800m, K. S. Hao 3959. **Hebei**, Mt. Wuling, alt. 1900-2100m J. B. Chen & S. L. Wang 89, 207, 261, 315.

2. *Anaptychia ethiopica* Swinsc. & Krog

The Lichenologist **8**: 111. 1976.

This species is similar to *A. ciliaris* and *A. setifera*, but separated from them by the presence of soralia composed of granular soredia. The soralia mainly localise on apical area and sometimes on margins of lobes. But soralia are often formed on the lower surface of the lobes near their apecies and become labriform for Chinese materials of this species. *A. ethiopica* may be regarded as the sorediate counterpart of *A. ciliaris* (Swinscow & Krog, 1976). This species is first known from Ethiopia of east Africa. It is new to China and known so far from Xinjiang.

Representative specimens examined: **Xinjiang**, Mt. Tianshan, alt 2500-2600m, X. Y. Wang 1016, 1290, 1298, 1324; Mt.Boukezha , alt. 2500m, T. N. Liou 3585.

3. *Anaptychia isidiza* Kurok.

Bein. Nova Hedwigia **6**: 19. 1962. —*Anaptychia palmulata* var. *isidiata* Zahlbr. Bot. Mag. (Tokyo) **41**: 364. 1927.

This species is characterized by having cylindrical isidia and more or less dorsiventral narrow lobules on the upper surface and margins of lobes, isidiate receptacle of apothecia, corticate lower surface and squarrosely and fasciculately branched rhizines.

A. isidiza is closely related to *A. palmulata*, but differ in having true isidia and isidiate receptacle of apothecia. Moreover, *A. isidiza* seems to be endemic to eastern Asia, while *A. palmulata* shows typical disjunctive distribution in eastern Asia and eastern North America. *A. isidiza* is considered as the isidiate counterpart of *A. palmulata* and might be derived from *A. palmulata* (Kurokawa, 1973).

Representative specimens examined **Heilongjiang**, Dailing, X. L. Chen 3690, 4093: J. C. Wei 2176, 2441. **Jilin**, Jiaohe, J. B. Chen & Y. M. Jiang 1065, 1076, 1120; Mt. Changbai, C. F. Zhao 3205, 4158; J. C. Wei 3067. **Liaoning** Xinbin couty, X. L.

Chen *et al.* 5651. 5741. **Nei mongol,** X. L. Chen 1363. **Shaanxi,** Mt. Taibai, J. B. Chen & Q. He 6416-1. **Hubei**, Shennongjia, J. B. Chen 10435, 10450. **Hunan,** sanzhi couty, J. B. Chen *et al.* 9782-1, 9824: Mt. Hengshan, J. D. Zhao 9903, 10287. **Anhui**, Mt. Huangshan, J. D. Zhao 5930. **Sichuan**, Mt. Emei, J. D. Zhao 6872, 6890, 7902, 8282.

4. ***Anaptychia palmulata*** (Michx.) Vain.

Termesz. Füzetek **22**: 299. 1899. —*Psoroma palmulata* Michx. Fl. Bot. Amer. **2**: 321. 1803. —*Physcia palmulata* (Michx.) Nyl. Lich. Jap. 33. 1890.

This species is similar and closely related to *A. fusca* and *A. isidiza*, but it is distinguished from *A. fusca* by greenish olive thallus and mainly squarrosely branched rhizines rather than chest-brown to blackish brown thallus and mainly simple rhizines in *A. fusca*, from *A. isidiza* by not having true isidia although having secondary short lacinules (lobules).

Representative specimens examined: **Jilin**, Jiaohe, alt. 1050m, J. B. Chen & Y. M. Jiang 1453; Dunhua couty, alt. 750m, C. F. Zhao 4018,4154; Mt. Changbai, alt. 1700m, J. L. Huo, 78205. **Heilongjiang,** Xiaoxing'anling, alt. 460m, X. L. Chen 3307, 5202. **Xizang**, Chayu (near Yunnan), alt. 3100m, J. J. Su 4445. **Yunnan**, Weixi, alt. 2700-2900m, X. Y. Wang et.al. 3863; J. J. Su 605. **Zhejiang**, Mt. Tianmu, J. D. Zhao 6062, 6139. **Anhui**, Mt. Huangshan, J. D. Zhao 5333, 5924. **Hubei**, Shennongjia, alt. 2630-3000m, J. B. Chen 10762, 11084. **Hunan,** Zhangjiajie, alt. 1000m, J. B. Chen *et al.* 9220. **Sichuan**, Mt. Emei, J. D. Zhao 8120

5. ***Anaptychia setifera*** (Mereschk.) Räs.

Ann. Acad. Sci. Fenn., ser. A. **34**: 123. 1931.

Anaptychia kaspica Gyel. Ann. Crypt. Exot. **4**:166, 1932.

This species is distinguished from *A. ciliaris* by narrower lobes and the presence of spinules on the receptacles of apothecia, and from *A. ethiopica* by the presence of the spinules and the abesence of soredia. *A. setifera* is widely distributed in the Northern Hemisphere, but is known in China for the first time, and known from Xinjiang only at present.

Representative specimens examined: **Xinjiang**, Mt. Tianshan, alt. 1800-2200m,

C. F. Zhao 2582, 2589, 2627.

6. *Anaptychia ulotrichoides* (Vain.) Vain.

Bot. Tidskr. **26**: 245. 1904. —*Physcia ulotrichoides* Vain., Act. Hort. Petrop. **10**: 553. 1888.

Anaptychia ulotrichoides f. *tenuior* (Vain.) Zahlbr., Cat. Lich. Univ. **7**: 743. 1931.

This species is characterized by sordid white to greyish thallus and usually forming rosettes colonies, lacking isidia and lobules, often wrinkled lobes, minute and hyaline hairs near the lobe tips, white and rugulose lower surface, laminal and sessile apothecia with entire margins and blackish brown disc with often pruinose. Therefore it is easily separated from species in *A. ciliaris* group and *A. fusca* group. The hairs on the lobe tips of *A. ulotrichoides* from Chinese materials completely agree with those described by Moberg (1980) who first observed the presence of the hairs of this species.

Representative specimens examined: **Xinjiang**, Mt. Tianshan, alt. 1500-3000m, X. Y. Wang 249, 334, 371, 389, 529, 544, 660, 820, **Gansu**, Mt. Qilian, alt. 2850m. C. F. Zhao. 2671.

We have not found specimens of this species from other localities of China although this species has its distribution in Xizang (Kurokawa, 1962; Wei, 1986) and Qinghai (Kurokawa, 1962).

Species excluded from China

Anaptychia runcinata (With.) Laundon

The Lichenologist **16**: 225. 1984

Anaptychia fusca (Huds.) Vain. Termész. Füzetak **22**: 299. 1899.

In China *A. runcinata* has only been reported by Zhao *et al.* (1982) under the name *A. fusca* based on a single specimen from Hubei province. In our study, this specimen is reidentified as *A. isidiza* because of the presence of isidia on the upper surface of lobes. As a result, *A. fusca* (= *A. runcinata*) should be excluded from the Chinese lichen flora.

Key to species of *Anaptychia* in China

1. Thallus loosely attached to the substratum, lobes linear-elongate and more or less ascending apically
    2.Thallus sorediate...*A. ethiopica*
    2.Thallus without soradia
        3. Lobes often more than 2mm wide, receptacle of apothecia without spinules ....*A. ciliaris*
        3. Lobes narrower, less than 2mm,receptacle of apothecia with spinules ....*A. setifera*
1.Thallus appressed to the substratum
    4.Thallus greyish to dirty white, lobe tips with hairs ... ***A. ulothrichoides***
    4.Thallus greenish olive to brownish, without hairs
        5.Upper surface and margins of lobes with cylindrical isidia...***A. isidiza***
        5.Thallus lacking isidia, often with dorsiventral lobules ...***A. palmulata***

Distribution of *Anaptychia* in China

Chinese distribution of *Anaptychia* is shown in figure 1. Four species, *A. ciliaris*, *A. ethiopica*, *A. setifera*, and *A. ulotrichoides*, mainly occur in Northwest of China, particularly in Xinjiang, whereas two species, *A. isidiza* and *A. palmulata*, have wide distribution range in China, but don't occur in western China. Which agree with distribution patterns of these species in the world. *A. isidiza* is a eastern Asia species and *A. palmulata* shows disjunctive distribution pattern in eastern Asia and eastern North American. Therefore the two species have wide distribution range in China except for western China and the tropic in China. On the contrary, *A. ciliaris* mainly is restricted to Europe. *A. ulotrichoides* shows a special distribution range, being known from American region, western China, and Mediterranean region (Kurokawa, 1973). Distribution of *A. ethiopica* isn't easily classified because it is known at present from East Africa and Xinjiang of China, which is noteworthy from a viewpoint of phytogeography.

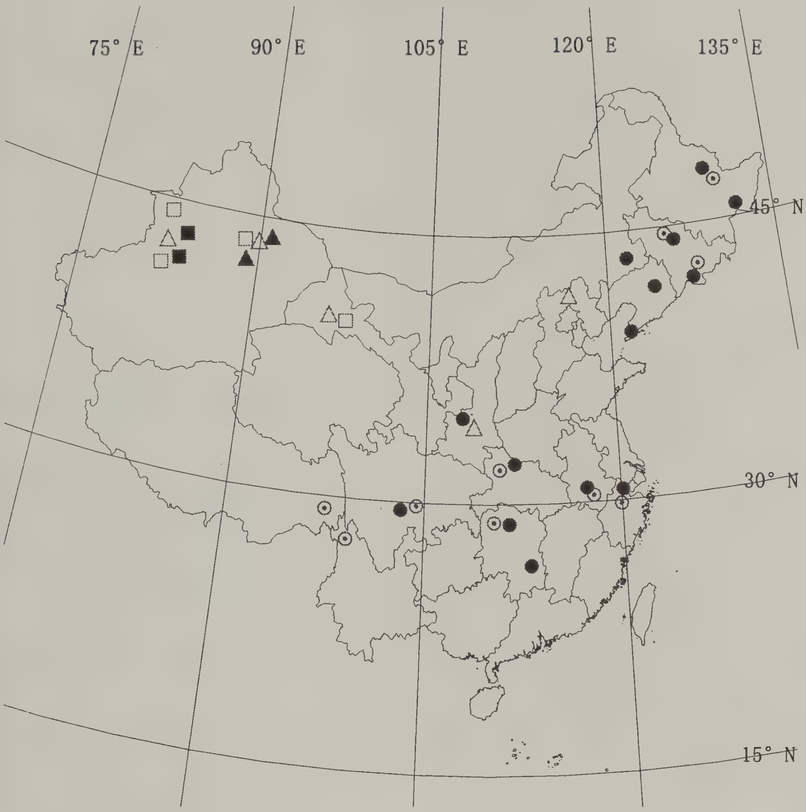

Fig. 1. Chinese distribution of *Anaptychia**. △: *A. ciliaris*. ▲: *A. ethiopica.* ■: *A. setifera*. ●: A. *isidiza*. ⊙: *A. palmulata*. □: *A. ulotrichoides*. *A few of localities recorded in literature are not shown in fig.1, because the authors have not seen the related specimens.

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References

Awasthi, D. D. & S. Singh, 1978. The lichen flora in the environs of Gangotri and Gomukh, India. Indian J. Forestry **1**: 138-146.

Kurokawa, S., 1962. A monograph of the Genus *Anaptychia*. Beih. Nova Hewigia **6**: 1-115.

Kurokawa, S., 1973. Supplementary notes on the genus *Anaptychia*. J. Hattori Bot. Lab. **37**: 563-607.

Moberg, R., 1980. *Anaptychia ulotrichoides* new to North America. The Bryologist **83**: 251—251.

Poelt, J., 1966. Zur kenntnis der Flechtengattung *Phyconia*. Nova Hedwigia **9**: 21-32.

Swinscow, T. D. V. & H. Krog, 1976. The genera *Anaptychia* and *Heterodermia* in East Africa. The Lichenologist **8**: 103-138.

Wei, J. C. & Y. M. Jiang, 1986. Lichens of Xizang. Science Press. Beijing.

Wei, J. C., 1991. An Enumeration of lichens in China. International Academic publishers. Beijing.

Zhao, J. D. *et al*. 1982. Prodromus lichenum Sinicorum. Science Press. Beijing.

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THE XYLARIACEAE OF TAIWAN (EXCLUDING ANTHOSTOMELLA)

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ABSTRACT

One hundred and eighteen xylariaceous fungi from Taiwan were studied, including seven taxa of ***Biscogniauxia***, one of ***Collodiscula***, one of ***Creosphaeria***, two of ***Daldinia***, one of ***Halorosellinia***, thirty-six of ***Hypoxylon***, three of ***Kretzschmaria***, seven of ***Nemania***, one of ***Rhopalostroma***, twelve of ***Rosellinia***, three of ***Stilbohypoxylon***, one of ***Whalleya***, and forty-three of ***Xylaria***. Twenty of these taxa could not be identified and may eventually be described as new. ***Hypoxylon ilanense***, ***Rosellinia formosana***, and ***Xylaria bambusicola*** are described as new. New combinations are proposed, as follow: ***Nemania memorabilis***, ***N. minutula***, ***Xylaria areolata***, and ***X. glebulosa***. Keys were constructed for included taxa. Cultures were obtained for ninety taxa. Many of these produced the anamorph in culture. In most cases conidiogenesis and conidiogenous cell proliferation were typical for xylariaceous fungi. Teleomorphs of several taxa of ***Xylaria***, one of ***Stilbohypoxylon***, and two of ***Nemania*** were induced in cultures. Comparisons were made among taxa found in Taiwan and those of some other areas where the xylariaceous mycobiota has been studied.

Key words: ***Biscogniauxia***, ***Collodiscula***, ***Creosphaeria***, ***Daldinia***, ***Halorosellinia***, ***Hypoxylon***, ***Kretzschmaria***, mycobiota, ***Nemania***, ***Rhopalostroma***, ***Rosellinia***, ***Stilbohypoxylon***, ***Whalleya***, ***Xylaria***

Taiwan is composed of Taiwan proper and seventy-seven satellite islands. It is on the border of continental Asia and the Pacific Ocean. It is southeast of mainland China and north of the Philippines. The area is 35,981 square km of which only 31.3% is below 100 m elevation. Taiwan is mountainous with 48 peaks over 3,000 m. Two climatic zones in Taiwan were recognized by Troll and Paffen (in Müller, 1982). The western plain area belongs to the tropical humid-summer zone and the rest of Taiwan belongs to the tropical rainy zone. On the other hand, three climatic zones were proposed by Köppen and Geiger (in Müller, 1982). The western plain belongs to the tropical savanna zone. The Heng-chun Peninsula belongs to the tropical rain forest zone. The rest of Taiwan belongs to the temperate rainy zone and is moist in all seasons. Additionally, the climate is influenced by two branches of the warm Japanese current and monsoons.

Seven vegetation belts corresponding to different altitudinal belts can be generally recognized in Taiwan (Chen, 1987): 1. coastal and tropical vegetation; 2. subtropical forest belt, the area below 700 m; 3. warm temperate mixed forest belt, the area from 700 to 1,800 m; 4. cool temperate coniferous forest belt, the area from 1,800 m to 2,500 m; 5. cold temperate coniferous forest belt, the area from 2,500 to 3,000 m; 6. subalpine coniferous forest belt, the area from 3,000 to 3,500 m; 7. alpine vegetation, the area above 3,500 m. Our collections were mostly made in altitudinal belts 1, 2 and, infrequently, 3.

Xylariaceous fungi generally have well-developed stromata. Gross morphology of stromata has been the criterion most frequently used to delimit genera. Species are delimited in part on ascospore characteristics. The ascospores of most species are inequilateral and unicellular at maturity. A germ slit can usually be found on either the flattened or convex side of ascospore. The ascospores of some species bear a cellular appendage at one end while immature. Depending upon the taxon, the appendage may persist or disintegrate as the ascospore matures. The apical rings of asci are also diagnostic for undoubted xylariaceous fungi. They stain blue in Melzer's reagent in most species. The details of these morphological features were reviewed by Rogers (1979).

Sawada (1928, 1931, 1933, 1959), who was probably the first person to describe xylariaceous fungi from Taiwan, described five species in his serial *Descriptive Catalogue of the Formosan Fungi*. These species are ***Daldinia concentrica*** (Bolton: Fr.) Ces. & De Not., ***Xylaria nigripes*** (Klotzsch) Cooke, ***X. tabacina*** (J. Kickx fil.) Fr., ***X. polymorpha*** (Pers.: Fr.) Grev., and ***Ustulina maxima*** (Weber) Wettst. Chen (1975) recorded ***Hypoxylon semiimmersum*** Nitschke and ***Kretzschmaria botrites*** C. G. Lloyd on hardwoods that were imported to Taiwan from Southeast Asia. Recently, Ju and Tzean (1985a, 1985b) described thirteen taxa of ***Hypoxylon*** and twenty-one taxa of ***Xylaria*** including two new species, ***X. formosana*** Y.-M. Ju & S.-S. Tzean and ***X. wulaiensis*** Y.-M. Ju & S.-S. Tzean, and one new variety, ***X. arbuscula var. plenofissura*** Y.-M. Ju & S.-S. Tzean. A plant pathogenic ***Xylaria***, which causes a root and basal stem rot disease of sugarcane, was reported by Hsieh (1980). Later, Fang et al. (1986) induced the teleomorph on the diseased cane stubble collected from the field and pointed out that this fungus resembles ***X. warburgii*** Henn. Specimens of xylariaceous fungi from Taiwan have been included in the following works: ***Rosellinia bambusae*** Henn. and ***R. mirabilis*** (Berk. & Broome) Y.-M. Ju & J. D. Rogers in Ju and Rogers (1990); ***Creosphaeria sassafras*** (Schwein.: Fr.) Y.-M. Ju, San Martín, & J. D. Rogers in Ju et al. (1993); ***Rosellinia corticium*** (Schwein.: Fr.) Sacc. in Petrini (1993); ***Nummularia minutula*** Penz. & Sacc. [≡ ***Nemania minutula*** (Penz. & Sacc.) Y.-M. Ju & J. D. Rogers] and ***Rosellinia sublimbata*** (Durieu & Mont.) Pass. in Ju and Rogers (1994); ***Astrocystis*** *species B* and ***Rosellinia*** *sp.* (IMI 323640) in Laessøe and Spooner (1994); a number of ***Hypoxylon*** taxa in Ju and Rogers (1996); ***Xylaria moelleroclavus*** J. D. Rogers, Y.-M. Ju, & Hemmes in Rogers et al. (1997); ***Stilbohypoxylon quisquiliarum*** (Mont.) J. D. Rogers & Y.-M. Ju in Rogers and Ju (1997); ***Daldinia childiae*** J. D. Rogers & Y.-M. Ju [as ***D. concentrica***

(Bolton: Fr.) Ces. & De Not.] and ***D. eschscholzii*** (Ehrenb.) Rehm in Ju et al. (1997); ***Whalleya microplaca*** (Berk. & M. A. Curtis) J. D. Rogers, Y.-M. Ju, & San Martín in Rogers et al. (1997); several ***Biscogniauxia*** taxa in Ju et al. (1998); and ***Kretzschmaria neocaledonica*** (Har. & Pat.) J. D. Rogers & Y.-M. Ju, ***K. pavimentosa*** (Ces.) P. Martin, ***K. zonata*** (Lév.) P. Martin, ***X. apoda*** (Berk. & Broome) J. D. Rogers & Y.-M. Ju, and ***X. intracolorata*** (J. D. Rogers, Callan, & Samuels) J. D. Rogers & Y.-M. Ju in Rogers and Ju (1998).

Several mycobiotic works have been done elsewhere in the general vicinity of Taiwan and many of the fungi treated are known from Taiwan or will probably be found there. Tai (1979) listed ten genera and 138 taxa of xylariaceous fungi in *Sylloge Fungorum Sinicorum*. Most taxa were collected from the southern provinces of China. Recently, Abe and Liu (1995) reported 14 xylariaceous fungi from Zhejiang Province, China: one species of ***Biscogniauxia***, eight of ***Hypoxylon***, one of ***Lopadostoma***, three of ***Nemania***, and one of ***Xylaria***. In Japan, Hino and Katumoto (1961) described one species of ***Astrocystis***, five of ***Hypoxylon***, and two of ***Rosellinia*** from bamboo culms. Katumoto (1978) recorded 11 species of ***Hypoxylon*** and mentioned some earlier works on ***Hypoxylon*** from Japan. Abe (1986a, 1986b) described the teleomorphs and the anamorphs of seven xylariaceous fungi collected on hardwoods from Japan. Hennings (1908) reported twenty species of xylariaceous fungi from the Philippines. Rehm (1913a, 1913b, 1913c, 1913d, 1914a, 1914b, 1915, 1916) published *Ascomycetes Philippinenses I-VIII* comprising numerous taxa of Xylariaceae. About the same time, Sydow and Sydow (1913, 1917) enumerated about thirty xylariaceous fungi from the Philippines. Later, Lloyd (1919) annotated some ***Xylaria*** species which he had seen from the Philippines. Carroll (1963) described ten species of ***Xylaria***, two of ***Hypoxylon***, two of ***Daldinia***, and one of ***Sarcoxylon*** from Thailand, and emphasized the morphology of the ascospore germ slit. Schumacher (1982) recorded one species of ***Daldinia*** and nine of ***Xylaria*** from northern Thailand. In that paper, he also validated ***X. scopiformis*** (Mont. *ex* Joly) Schum. Joly (1968) made a contribution to the ***Xylaria*** mycobiota of Vietnam. Therein, several taxa were cultured and a number of illustrations were provided. Several works have treated Indonesian fungi (e.g., Hennings, 1893; Penzig and Saccardo, 1904) but the primary objectives were not xylariaceous fungi. A recent investigation of Rogers et al. (1987) in North Sulawesi has emphasized xylariaceous fungi. Sixty taxa were described, including one new species of ***Hypoxylon***, one new species of ***Kretzschmaria*** and two new taxa of ***Xylaria***. From Papua New Guinea, Dennis (1974) listed 12 species of ***Xylaria***, one of ***Daldinia***, one of ***Kretzschmaria***, and one of ***Poronia***. Studies of xylariaceous mycobiota from this region was greatly enriched by Van der Gucht (1995) who treated seven genera and 64 taxa from her collections. Later, Van der Gucht et al. (1997) described four new ***Hypoxylon*** species and provided an updated key to the known taxa of ***Hypoxylon*** from Papua New Guinea.

This work is a mycobiotic study of the xylariaceous fungi from Taiwan. Although collections were made from approximately sixty sites in Taiwan, most were from three general localities, Taipei County, Nan-tou County, and Ping-tung County. These counties can be fitted into two of the three climatic zones in Taiwan defined by Köppen and Geiger (in Müller, 1982). Taipei and Nan-tou County belong to the temperate rainy climate, and Ping-tung County belongs to the tropical rain forest climate which is moist in all seasons. Nonetheless, if the Troll and Paffen (in Müller, 1982) climatic zone system is used, all of these three counties will belong to the tropical rainy climate.

In this study, descriptions are given only for those taxa which have not been described elsewhere or which have been described unsatisfactorily. For those taxa that have been well-described, readers are referred to literature where a well-prepared description can be found. Taxonomic problems are also discussed in NOTES following the taxa involved. In total, one hundred and eighteen taxa are included in the study, a large number of which have been cultured. Illustrations and/or photographs are provided for the teleomorphs, the anamorphs, or both, of some taxa. Dichotomous keys are presented for the included taxa. It should be noted that ***Anthostomella*** is not included in this study primarily because of the lack of a comprehensive treatment on the genus.

MATERIALS AND METHODS

Most fungal collections on which this study is based are from three general localities in Taiwan: Taipei County, Nan-tou County, and Ping-tung County. These counties are in, respectively, the north, the center, and the south of Taiwan. Most collections were obtained from dead wood. A few of them were from fallen leaves and termite nests. Collected materials were air-dried and then were shipped to Pullman. Collections cited under SPECIMEN(S) EXAMINED in the descriptive section were collected from Taiwan. Collections cited under ADDITIONAL SPECIMEN(S) EXAMINED were not from Taiwan.

For initiating cultures, a portion of the stromatal surface including the upper parts of perithecia were removed with a sterilized razor blade. The contents of the exposed perithecia were scooped out and spotted with a sterilized needle in Petri dishes containing Difco potato-dextrose agar to which 5 g/L Difco yeast extract was added (PDYA). Hyphal tips emerging from the perithecial contents then were cut and transferred to fresh media. Therefore, the isolates obtained presumably originated from multiple ascospores. Isolates were cultured on Difco oatmeal agar (OA) in 9-cm diameter plastic Petri dishes that were incubated on a laboratory bench at ca. 20°C under 12 hours fluorescent light. All cultural descriptions are from colonies on OA unless otherwise noted.

Single spore cultures were obtained by manually manipulating spores with a sterilized fine glass needle under a dissecting microscope. Ascospore masses were streaked on to 2% water agar. Single ascospores were moved by a glass needle into a clean area of the agar plate. A small knife was used to cut the agar around the single ascospore into a small block which was then transferred to PDYA plates.

Some xylariaceous fungi can be induced to produce their teleomorphs in axenic cultures by various methods. The teleomorphs of several ***Xylaria*** taxa were induced by transferring stromata which had been produced on OA to Petri dishes containing 20 g/L Difco malt extract and 17.7 g/L Difco Bacto agar [SMEA, Scratch Malt Extract Agar, Kenerley & Rogers (1976)]. Mature perithecia could be observed in one to two months after the transfer, depending on the species. The teleomorphs of ***Nemania minutula*** and ***Stilbohypoxylon*** *sp.* (77062107) were seen in one to two months after the entire intact colonies, which had been cultured on OA for one to two months, were laid over SMEA in Petri plates. ***Nemania*** *sp.* (76100601) produced the teleomorph within one and a half months when it was cultured exclusively on SMEA.

Teleomorphic materials were prepared for examination by crushing centrum contents beneath a coverslip. Cultured materials were observed by mounting small amounts of mycelium in water beneath coverslips. Melzer's iodine reagent (potassium iodine, 1.5 gm; iodine, 0.5 gm; distilled water, 20.0 ml; chloral hydrate, saturated solution, 20.0 ml) was employed to stain the ascal apical rings. An Olympus BH-2 microscope was used for observations and measurements. Illustrations were made with the aid of an Olympus BH2-DA drawing attachment. In ***Daldinia***, ***Hypoxylon***, and ***Rhopalostroma***, color codes of Rayner (1970) were used to record stromatal surface color and stromatal pigments extracted by 10% KOH solution.

KEY TO GENERA OF XYLARIACEAE FROM TAIWAN*

1. Stromata bipartite, with an outer membrane or layer dehiscing to expose ostiolar openings 2
1. Stromata essentially unipartite, although some may have an outer peeling layer 3
    2. Perithecia embedded in black carbonaceous or brown woody stromatal tissue; conidia ellipsoid; on wood..... ***Biscogniauxia*** Kuntze
    2. Perithecia embedded in whitish coriaceous stromatal tissue; conidia scolecosporous; on wood ....***Whalleya*** J. D. Rogers, Y.-M. Ju, & San Martín (***W. microplaca***)
3. Stromata essentially uniperitheciate 4
3. Stromata usually multiperitheciate.. 9
    4. Stromata mostly immersed in substrate; anamorph various†; in leaves, twigs, or wood ....***Anthostomella*** Sacc. (not further treated herein)

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[*] This key is largely modified from "KEY TO GENERA OF XYLARIACEAE" in Ju and Rogers (1996) for the genera known in Taiwan. When a given genus is represented by only one taxon, the taxon name is provided in the parentheses.

[†] Both ***Nodulisporium***-like and ***Libertella*** anamorphs have been connected with this genus. Thus, ***Anthostomella*** is very likely heterogeneous. Recently, Rappaz (1995) apparently restricted the concept of ***Anthostomella*** to those taxa having ascospores "unequally two celled at the beginning of their formation."

  4. Stromata erumpent or superficial 5

5. Stromata with orange granules; anamorph ***Libertella***; on wood................ .... ***Creosphaeria*** Theiss. (***C. sassafras***)

5. Stromata lacking orange granules 6

  6. Stromata usually associated with subiculum; ascospores one-celled, with a germ slit, bearing hyaline cellular appendages in some taxa; anamorph ***Geniculosporium***-like (***Geniculosporium***, ***Dematophora***, or ***Acanthodochium***); on wood................................ ....***Rosellinia*** De Not.[*]

  6. Stromata not associated with subiculum..7

7. Ascospores two-celled, lacking a germination site; anamorph ***Geniculosporium***-like (***Acanthodochium***); on bamboo culms .... ***Collodiscula*** Hino & Katumoto (***C. japonica***)

7. Ascospores one-celled, with a germ slit; anamorph ***Geniculosporium***-like; on wood 8

  8. Anamorph not borne on synnemata; on mangrove wood .... ***Halorosellinia*** (***H. oceanica***)

  8. Anamorph borne on synnemata; not known on mangrove wood .... ***Stilbohypoxylon*** Henn.

9. Stromatal interior with well-defined concentric rings; anamorph ***Nodulisporium***-like; on wood .... ***Daldinia*** Ces. & De Not.

9. Stromatal interior lacking well-defined concentric rings; on wood and/or other substrates...10

  10. Stromata upright, usually several times higher than broad, sessile to distinctly stipitate 11

  10. Stromata otherwise, if upright, usually not higher than broad...........13

11. Asci lacking an apical ring; Stromata usually more or less clavate; perithecia entirely immersed; anamorph ***Nodulisporium***-like; on wood .... ***Rhopalostroma*** D. Hawksworth (***R. luzonense***)

11. Asci usually with an apical ring; on wood and/or other substrates 12

  12. Stromata stipitate, flat-topped to pulvinate, often aggregated into a crust-like mass; anamorph ***Geniculosporium***-like; on wood.............. ....***Kretzschmaria*** Fr.

  12. Stromata sessile to stipitate, shaped variously, but usually not aggregated into a crust-like mass; anamorph ***Geniculosporium***-like; on wood, seeds, fruits, leaves, insect nests, etc. ....***Xylaria*** Hill *ex* Schrank[†]

13. Stromata usually with KOH-extractable pigments; ascospores with the germ slit usually on the convex side; perispore of many taxa dehiscent in KOH; anamorph ***Nodulisporium***-like; on wood.............. ***Hypoxylon*** Bull.

13. Stromata lacking KOH-extractable pigments; ascospores with the germ slit usually on the flat or concave side; perispore not dehiscent in KOH.....

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[*] Includes ***Astrocystis*** Berk. & Broome. ***Stilbohypoxylon*** species bear spikes of synnematal origin on the top of uniperitheciate stromata. The spikes tend to fall off easily and can be hard to find on mature stromata.

[†] Sessile forms are usually referred to ***Penzigia*** Sacc. They are also keyed out through "penzigioid fungi."

.... 14

14. Stromata pulvinate to effused-pulvinate, usually attached to the substrate by the entire base; anamorph ***Geniculosporium***-like; on wood .... ***Nemania*** S. F. Gray

14. Stromata peltate, restricted-pulvinate, to widely effused, attached to the substrate by narrow connective or with the base strongly constricted; anamorph ***Geniculosporium***-like; on wood 15

15. Stromata widely effused .... ***Kretzschmaria*** Fr.[*]

15. Stromata restricted-pulvinate .... penzigioid fungi

KEY TO TAXA OF ***BISCOGNIAUXIA*** TREATED

1. Ascospores bearing a cellular appendage 2
1. Ascospores not bearing a cellular appendage.. 3
    2. Ascospores 22-27 (not including appendage) x 11.5-13 µm .... ***B. philippinensis***
    2. Ascospores 10-11.5 (not including appendage) x 5-6.5 µm .... ***B. uniapiculata***
3. Ascospores 19.5-23 x (10-)11-13 µm............................ ***B.*** *sp.* (80091405)
3. Ascospores smaller 4
    4. Ascospores strongly inequilateral, 10.5-12.5 x 5.5-7.5 µm.. ***B. citriformis***
    4. Ascospores nearly equilateral 5
5. Perithecia 0.05 mm diam or less x 0.3-0.5 mm high, with numerous perithecia arranged in rosettes and emerging through a single ostiolar canal; ascospores 11-14 x 5.5-7.5 µm .... ***B. plana***
5. Perithecia more than 0.2 mm diam, usually not arranged in rosettes 6
    6. Ascospores 8.5-15 x 5-7.5 µm.. ***B. capnodes***
    6. Ascospores (14-)15-22.5(-24) x 8-11(-12) µm... ***B. capnodes var. rumpens***

KEY TO TAXA OF ***DALDINIA*** TREATED

1. Stromatal pigments extracted in KOH olivaceous, greenish, yellowish, or ochraceous [isabelline (65), hazel (88), honey (64), amber (47), or cinnamon (62)]; ascospores 12-16 x 5.5-7.5 µm .... ***D. childiae***
1. Stromatal pigments extracted in KOH dark livid (80), vinaceous gray (116), livid purple (81), vinaceous purple (101), livid violet (79), or lacking; ascospores 10-14(-15.5) x 5-6.5 µm ....***D. eschscholzii***

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[*] Resupinate ***Kretzschmaria*** species were formerly placed in ***Ustulina*** Tul. & C. Tul.

KEY TO TAXA OF *HYPOXYLON* TREATED

1. Stromatal surface usually colored when mature, infrequently blackened; lacking carbonization of stromatal layer directly surrounding perithecia; ostioles usually lower than the level of stromatal surface (umbilicate), less frequently at the same level or slightly higher than the level of stromatal surface (papillate), usually not encircled with an annulate disc; perispore, when dehiscing, with conspicuous to very inconspicuous transverse coil-like ornamentation visible (section ***Hypoxylon***) 2
1. Stromatal surface usually blackened when mature, infrequently colored; carbonaceous stromatal layer discretely surrounding each perithecium; ostioles always higher than the level of surrounding stromatal surface (papillate), encircled by an annulate disc or annulate disc lacking; perispore, when dehiscing, with a thickened area visible at the position of ca. 1/3 ascospore length from one end on the same side as the germ slit (section ***Annulata***) 28
   2. Stromata with surface honey (64), isabelline (65), gray olivaceous (107), or olivaceous (48), glomerate, usually containing less than 20 perithecia, with KOH-extractable pigments pure yellow (14) with citrine (13) tone, greenish olivaceous (90), or orange (7); ascospores 9-13 x (4-)4.5-6 μm .... ***H. musceum***
   2. Stromata with surface other than above colors 3
3. Ostioles higher than the stromatal surface (papillate); mature stromata with blackish surface, not melted by a hot needle; ascospores 7-11 x 3.5-4.5(-5) μm .... ***H. monticulosum***
3. Ostioles lower than the stromatal surface (umbilicate) to, infrequently, at the same level as the stromatal surface; if higher than the stromatal surface (papillate), mature stromata with colored surface, easily melted by a hot needle 4
   4. Ascospores nearly equilateral to slightly inequilateral, with perispore dehiscent or indehiscent in 10% KOH 5
   4. Ascospores conspicuously inequilateral, with perispore dehiscent in 10% KOH 8
5. Stromatal surface brown vinaceous (84), dark brick (60), or sepia (63); ascospores short fusoid, nearly equilateral, with nearly acute ends, (6.5-)7-9 x 3-4 μm, with slightly oblique to sigmoid germ slit less than spore-length to, less frequently, nearly spore-length, with perispore dehiscent in 10% KOH .... ***H. hypomiltum***
5. Ascospores with perispore not dehiscent in 10% KOH 6
   6. Stromata with fulvous (43), rust (39), sienna (8), ochreous (44), or apricot (42) surface, with orange red granules; ascospores brown to dark brown, ellipsoid, nearly equilateral, with broadly to narrowly rounded ends, 9.5-14 x 5-7.5 μm, with germ slit spore-length .... ***H. cinnabarinum***
   6. Stromatal surface with vinaceous shades 7
7. Stromata with KOH-extractable pigments honey (65), amber (47), isabelline (65), greenish yellow (16), dull green (70), or dark green (21);

ascospores (6-)6.5-9.5(-10) x 3-4.5 µm, with faint, straight germ slit less than to slightly less than spore-length.................................. ***H. investiens***

7. Stromata with KOH-extractable pigments brick (59); ascospores light brown to brown, 11-14.5 x (4.5-)5-6.5 µm, with straight germ slit less than to slightly less than spore-length.......................................***H. parksianum***

8. Stromata always with very conspicuous perithecial mounds, usually with half to entire perithecial mounds exposed, glomerate to effused-pulvinate; surface grayish sepia (106), fuscous (103), or brown vinaceous (84); dull orange brown or dark brown granules immediately beneath surface and between perithecia, with KOH-extractable pigments hazel (88), sienna (8), cinnamon (62), fulvous (43), umber (9), or ochreous (44); perithecia spherical, 0.3-0.5(-0.6) mm diam; ostioles slightly higher than the stromatal surface; ascospores brown to dark brown, 9.5-15(-16) x 4-6.5(-7) µm............... .... ***H. lenormandii***

8. Stromata plane or with inconspicuous to conspicuous perithecial mounds...9

9. Stromata containing dull brown, dull reddish brown, or black granules, with KOH-extractable pigments purplish [dark livid (80), dark violet (33), livid purple (81), or livid violet (79)]...11

9. Combination of characters not as above 10

10. Stromata containing orange red, orange, dull orange, orange brown, yellowish brown, rust, or, less frequently, dull brown granules, with KOH-extractable pigments orange, reddish, or rust [orange (7), luteous (12), ochreous (44), sienna (8), scarlet (5), fulvous (43), or rust (39)]..12

10. Stromata containing buff, light brown, dull brown, dull reddish brown, or black granules, with KOH-extractable pigments yellowish, greenish yellow, dull green, or olivaceous [pure yellow (14), amber (47), pure yellow (14) with greenish yellow (14) tone, isabelline (65), honey (64), hazel (88), olivaceous (48), greenish olivaceous (90), dull green (70), gray olivaceous (107), or olivaceous gray (121)]; if containing dull orange or orange-brown granules, then with KOH-extractable pigments other than those in above couplet 19

11. Ascospores light brown to brown, 6-7.5 x 3-3.5 µm.....***H. lienhwacheense***

11. Ascospores dark brown, 11-12.5 x 4.5-5 µm.........................***H. lividicolor***

12. Stromatal surface fulvous (43), sienna (8), or rust (39); perithecia tubular, 0.3-0.6 mm diam x 0.8-2.5(-3) mm high; asci with stipe greater than 150 µm in length; ascospores 13.5-18(-19) x 7-8(-8.5) µm .... ***H. haematostroma***

12. Ascospores mostly less than 14 µm long and less than 6.5 µm broad 13

13. Stromata with dull-colored granules—rust, orange brown, yellowish brown, or dull orange; ascospores with broadly to narrowly rounded ends, 8-10.5 x 4.5-5 µm, with slightly oblique germ slit much less than spore-length...***H. sp.*** (80091401)

13. Stromata with bright-colored granules—yellowish orange, orange, or orange red...14

    14. Stromatal surface with vinaceous shades 15
    14. Stromatal surface without vinaceous shades 16
15. Ascospores (9-)9.5-12 x 4.5-5 µm, with conspicuous coil-like ornamentation on perispore .... ***H. retpela***
15. Ascospores (8-)9-12 x 4-5.5 µm, smooth or with inconspicuous coil-like ornamentation on perispore .... ***H. fendleri***
    16. Ostioles conical-papillate to papillate; perithecia spherical, 0.1-0.2 mm diam; ascospores 7.5-9.5 x 3.5-4.5 µm .... ***H. rutilum***
    16. Ostioles lower than or barely raised above the level of stromatal surface 17
17. Ascospores (4.5-)5-7 x 2.5-3.5 µm .... ***H. subgilvum var. microsporum***
17. Ascospores usually greater than 9.5 µm long 18
    18. Ascospores (9-)9.5-15(-17.5) x 4-7(-7.5) µm; conidia 5-7.5 x 3-4 µm .... ***H. crocopeplum****
    18. Ascospores 7-11 x 3.5-5 µm; conidia 3-4.5 x 1.5-2 µm .... ***H. subgilvum***
19. Ascospores light brown to brown, with narrowly rounded ends, 5.5-8 x 2.5-3.5 µm .... ***H. brevisporum***
19. Ascospores greater than 7 µm in length and greater than 3.5 µm in breadth 20
    20. Stromata associated with bamboo culms; ascospores 8.5-12(-13.5) x 4-5(-5.5) µm .... ***H. pilgerianum***
    20. Stromata not associated with bamboo culms 21
21. Asci with apical ring highly reduced or lacking, not bluing in Melzer's iodine reagent; ascospores (11-)12-16 x (5.5-)6-7.5 µm .... ***H. notatum***
21. Asci with apical ring bluing in Melzer's iodine reagent 22
    22. Ascospores with very conspicuous coil-like ornamentation on perispore, 9.5-13(-14.5) x 4.5-6.5 µm .... ***H. duranii***
    22. Ascospores with smooth to inconspicuous coil-like ornamentation on perispore 23
23. Stromata with granules light-colored [yellowish orange, light orange-brown, ochraceous, brownish yellow, or buff] 24
23. Stromata with granules dull-colored [dull orange brown, dull reddish brown, dark brown, or black] 25
    24. Stromata effused-pulvinate; perithecia obovate, oblong, to tubular, 0.2-0.4 mm diam x 0.3-1.2 mm high; ascospores 8-11 x 3.5-4.5 µm .... ***H. trugodes***
    24. Stromata usually pulvinate to hemispherical, sometimes effused-pulvinate; perithecia usually spherical to obovate, 0.1-0.3(-0.4) mm diam x 0.2-0.5 mm high; ascospores 8-20 x 4-8 µm .... ***H. fuscum***
25. Stromata with KOH-extractable pigments amber (47) with greenish yellow (16) tone, or greenish yellow (16) with citrine (13) tone; ostioles usually

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* ***Hypoxylon crocopeplum*** generally has a larger ascospore size range than ***H. subgilvum***. When the ascospore size of a specimen falls into the overlapping range of these two taxa, the conidium size must be relied upon.

overlain with conspicuous white substance; ascospores (8-)9-12(-13) x 4-6 µm .... ***H. perforatum***

25. Stromata with KOH-extractable pigments isabelline (65), olivaceous (48), gray olivaceous (107), greenish olivaceous (90), or amber (47); ostioles overlain with inconspicuous white substance or lacking white substance 26

26. Ascospores 8-20 x 4-8 µm; conidiogenous structure ***Virgariella***-like; often occurring on ***Alnus*** .... ***H. fuscum***

26. Conidiogenous structure ***Nodulisporium***-like or ***Periconiella***-like; not known to occur on ***Alnus*** 27

27. Ascospores 12-14(-15) x 6-7 µm; conidiogenous structure ***Nodulisporium***-like .... ***H.*** *sp.* (80091101)

27. Ascospores 11-13.5 x 5-6 µm; conidiogenous structure ***Periconiella***-like .... ***H.*** *sp.* (77082404)

28. Stromata with KOH-extractable pigments vinaceous purple (101) or vinaceous gray (116); ascospores pale brown, 9-14(-17) x 3.5-4.5 µm, with germ slit much less than spore-length originating from one end .... ***H. urceolatum***

28. Combination of characters not as above 29

29. Stromata with KOH-extractable pigments livid red (56), vinaceous (57), brick (59), or bay (6); ostioles not encircled by a disc; ascospores 6.5-7.5(-8) x 3-4 µm, with straight germ slit less than spore-length .... ***H. cohaerens*** *var.* ***microsporum***

29. Ostioles encircled by a disc 30

30. Ascospores 5-7 x 2-3 µm, with germ slit on the flattened side 31

30. Ascospores with germ slit on the convex side 32

31. Mature stromata usually shiny black; conidiogenous structure ***Periconiella***-like .... ***H. stygium***

31. Mature stromata rose-colored with black ostiolar region; conidiogenous structure ***Nodulisporium***-like .... ***H. atroroseum***

32. Ostiolar discs not exceeding 0.2 mm diam 33

32. Ostiolar discs exceeding 0.2 mm diam 34

33. Ascospores 5.5-6 x 2.5-3 µm .... ***H. ilanense***

33. Ascospores 10-12 x 4-5 µm .... ***H. moriforme*** *var.* ***microdiscus***

34. Stromata with KOH-extractable pigments greenish olivaceous (90); ostiolar discs variable, but a few to many up to 0.7 mm in any collection; ascospores 8.5-10.5 x 4-5 µm, with straight germ slit spore-length .... ***H. bovei*** *var.* ***microspora***

34. Ostiolar discs 0.2-0.5 mm diam 35

35. Mature stromata shiny black, with greenish olivaceous (90) KOH-extractable pigments; ascospores 6.5-10 x 3-4.5 µm .... ***H. nitens***

35. Mature stromata dull brownish, blackish, or with olive tones, glomerate, pulvinate, hemispherical, or effused-pulvinate 36

36. Stromata usually less than 2 mm thick, with conspicuous to inconspicuous perithecial mounds; ascospores 6-9 x 2.5-4 µm .... ***H. moriforme***

36. Stromata usually more than 2 mm thick, with inconspicuous perithecial mounds; ascospores 7.5-10.5(-11) x 3.5-5(-6) µm .... ***H. annulatum***

KEY TO TAXA OF *KRETZSCHMARIA* OR KRETZSCHMARIOID *XYLARIA* TREATED

1. Ascospores longer than 20 µm 2
1. Ascospores shorter than 20 µm 4
    2. Stromata obconical, turbinate to clavate, stipitate or sessile; fertile parts seldom exceeding 1 cm diam; ascospores (31-)35-40(-42) x 6-7 µm .... ***K. neocaledonica***
    2. Stromata resupinate, sessile; fertile part usually exceeding 1 cm diam 3
3. Ascospores 35-43 x 7-9.5 µm, with germ slit much less than spore-length. .... ***K. pavimentosa***
3. Ascospores 29.5-34 x 9-11 µm, with germ slit spore-length or nearly so .... ***K. zonata***
    4. Stromata with yellow to orange tissue immediately beneath the surface; ascospores (9-)9.5-11 x 4.5-6 µm .... ***Xylaria intracolorata***
    4. Stromata lacking yellow to orange tissue 5
5. Ascospores 11.5-12.5(-13.5) x 5.5-6.5(-7) µm .... ***Xylaria cf. heliscus***
5. Ascospores 9-11(-11.5) x 4-4.5 µm .... ***Xylaria apoda***

KEY TO TAXA OF *NEMANIA* TREATED

1. Stromata pulvinate, 1-1.5 mm thick, blackish, usually with evident perithecial mounds; perithecia 1-1.2 mm diam; ostioles encircled by a minute disc 0.1-0.2 mm diam; ascospores dark brown, with narrowly rounded ends, 10.5-13.5 x 4.5-6 µm, with straight germ slit spore-length on the flattened side .... ***N. bipapillata***
1. Ostioles not encircled by a disc 2
    2. Stromata growing on bamboo culms, blackish, with whitish to grayish, soft tissue between perithecia; perithecia spherical to obovate, 0.1-0.2 mm diam; ostioles faintly papillate; ascospores brown, oblong ellipsoid-inequilateral to fusoid, with narrowly rounded ends, 10.5-13(-14) x 4-5(-5.5) µm, with a straight germ slit slightly less than spore-length on the flattened side .... ***N. minutula***
    2. Stromata not growing on bamboo culms 3
3. Ascospores 17-22 x 6-7 µm, with germ slit much less than spore-length on the convex side .... ***N****. sp.* (80082010)
3. Ascospores smaller 4
    4. Stromata with lower to middle part embedded in substrate, 0.5-0.6 mm diam; ostioles obtusely conical; ascospores light brown to brown,

ellipsoid, with broadly rounded ends, 9-12 x 5-6(-6.5) µm, with a straight germ slit much less than spore-length......... ***N.*** *sp.* (76100601)

4. Stromata superficial or nearly so; ascospores with narrowly rounded ends..5

5. Stromata 1-2.5 cm long x 0.7-1.2 cm broad x 0.7-1 mm thick, blackish brown, with black carbonaceous tissue between perithecia; perithecia spherical, 0.7-0.9 mm diam; ostioles minutely papillate; ascospores light brown, 10-12 x 4.5-5 µm, with a straight, much less than spore-length germ slit.. ***N. atropurpurea***

5. Ascospores brown to dark brown, with a slightly less than spore-length germ slit..6

6. Stromata discoid or restricted pulvinate, with abrupt margins; ostioles conic-papillate; ascospores 10-12(-12.5) x 4-5 µm ..... ***N. memorabilis***

6. Stromata effused-pulvinate, with sloping margins; ostioles faintly papillate; ascospores 10.5-13(-15) x 4.5-6 µm..................... ***N. diffusa***

KEY TO TAXA OF PENZIGIOID FUNGI TREATED (INCLUDING PENZIGIOID *XYLARIA*)

1. Stromata usually containing one to a few perithecia, frequently rosellinioid...2

1. Stromata of various shape, usually containing numerous perithecia 3

2. Stromata usually found in mangrove environments, conical to hemispherical, 1-2 mm long x 1-1.5 mm broad x 1 mm high, blackish; perithecia 0.8-1 mm diam; ostioles papillate; ascospores brown to dark brown, often pinched at one end, 22.5-26(-28) x 11.5-13(-13.5) µm, with straight germ slit less than spore-length on flattened side .... ***Halorosellinia oceanica***

2. Stromata usually densely aggregated, pulvinate, bearing one to several perithecia, 1.5-2.5 mm diam x 1-1.5 mm high, with surface smooth; perithecia spherical, 0.6-0.8 mm diam; ostioles conic-papillate; ascospores brown, broadly ellipsoid, with broadly rounded ends, (12-)13-15(-17) x 7.5-8.5(-9) µm, with long spiral germ slit......... .... ***Xylaria*** *sp.* (77010712)

3. Stromata discoid, 1-3 mm diam x 0.5-0.6 mm thick, with base narrowly attached to substrate; surface smooth, plane or with inconspicuous perithecial elevations; ascospores pale brown, with broadly rounded ends, 5-6 x 2-2.5 µm, with a very faint germ slit..................... ***Xylaria frustulosa***

3. Ascospores larger 4

4. Ascospores shorter than 13 µm...5

4. Ascospores larger 6

5. Fertile part clavate on short stipe, 0.5-5 cm total length x 0.5-1.3 cm diam, or, infrequently, discoid, 2.5-7.5 mm diam x 1-1.5 mm thick, brown to dark brown; surface smooth or ornamented with network of fine cracks; ascospores blackish, 8-10.5 x 4-5 µm, mostly with very inconspicuous germ slit... ***Xylaria cubensis***

5. Fertile part peltate to broadly obconical, with flattened top and a narrow central connection, 2-3 mm thick x 3-10 mm diam, dark brown to black; surface smooth except for a few irregular major cracks; ostioles papillate; ascospores blackish, with narrowly rounded to abruptly pinched ends, 11-13 x 5.5-7 µm, with straight germ slit less than spore-length .... ***Xylaria berteri***
   6. Stromata with white scales on surface; ascospores blackish brown, ellipsoid-inequilateral, with broadly rounded ends, 28-33 x 8.5-10 µm, with a noncellular, hyaline appendage 2-3 µm long on each end, with straight germ slit nearly spore-length........................ ***Xylaria areolata***
   6. Stromata lacking white scales on surface; ascospores with narrowly rounded ends, with short, oblique germ slit.......................................7
7. Fertile part pulvinate to globose, with flattened to slightly convex top, on narrow central connective, 1.5-2(-3) mm high x 1-3 mm diam, dark brown to black; surface roughened with conspicuous reticulate cracks; ostioles hemispherical; ascospores 27-31 x 8-10 µm................ ***Xylaria glebulosa***
7. Ascospores smaller 8
   8. Fertile part subglobose to elongated, sessile or with short to long stipe, 0.2-5 cm x 1-7 mm diam, dark brown; surface with conspicuous perithecial contours and minute cracks; ostioles hemispherical; ascospores (21-)22-27(-30) x 7-9(-9.5) µm.......... ***Xylaria anisopleura***
   8. Fertile part pulvinate, on narrow central connection, 1.5-2 mm high x 1.5-3 mm diam, dark brown; surface roughened with fine cracks; ostioles faintly papillate; ascospores 19-23.5 x 6.5-7.5 µm .... ***Xylaria atrosphaerica***

KEY TO TAXA OF *ROSELLINIA* TREATED

1. Ascospores usually greater than 65 µm long 2
1. Ascospores usually less than 65 µm long 4
   2. Stromata 1.7-2 mm diam, with rugose surface, usually associated with subiculum; ostioles slightly papillate; ascospores brown to dark brown, with long tapered ends, 90-122 x 7-9 µm, with the straight germ slit much less than spore-length on the convex side .... ***R. bunodes***
   2. Stromata with smooth, polished surface; ascospores without long tapered ends; combination of other features differing from above 3
3. Stromata growing on dicot wood, 0.8-1 mm diam, with lower part embedded in dark purplish brown subiculum: ostioles conic-papillate; ascospores brown, with narrowly rounded ends, surrounded by a hyaline sheath, 70-90 x 10-15 µm, with the straight germ slit spore-length on the flattened side .... ***R. procera***
3. Stromata growing on monocot material, produced at the center of a hyphal mat; ostioles conical; ascospores brown, with narrowly rounded ends, with a hyaline sheath, (71-)78-98 x 8.5-11.3 µm, with the straight germ slit spore-length on flattened side .... ***R. formosana***

4. Stromata growing on monocot material 5

4. Stromata growing on dicot wood 7

5. Stromata 0.6-0.8 mm diam, with mixed cuticular and outer stromatic material adhering to upper surface and closely encircling at base to midportion; ascospores brown, with broadly rounded ends each bearing a hyaline noncellular appendage, (14.5-)15-18(-20) x 6.5-7.5(-8) µm, with the straight germ slit spore-length or nearly so on the flattened side .... ***R. sublimbata***

5. Stromata with collar-like outer stromatal layer encircling at base to midportion; combination of other features differing from above 6

6. Stromata 0.4-0.6 mm diam, superficial or only rupturing the cuticular layer of bamboo; ascospores brown, oblong ellipsoid-inequilateral or some what fusoid, 10.5-15(-16) x 4-6 µm, with the straight germ slit spore-length or nearly so on the flattened side, often with hyaline sheath .... ***R. bambusae***

6. Stromata with top somewhat flattened, erumpent by rupturing epidermal layer of bamboo, 0.5-0.7 mm diam; ascospores brown to dark brown, ellipsoid-inequilateral, (10.3-)11.5-14 x 6-7.5 µm, with the straight germ slit slightly less than spore-length on the flattened side, usually with hyaline sheath .... ***R. mirabilis***

7. Mature stromata apparently not associated with subiculum 8

7. Mature stromata clearly associated with subiculum 9

8. Stromata ovate, 0.7-1 mm diam x 1-1.2 mm high; ostioles dome-shaped; ascospores light brown, fusoid-inequilateral, 38-65 x 9-12 µm, with the straight germ slit spore-length frequently on the convex side .... ***R. lamprostoma***

8. Stromata globose, 0.6-0.8 mm diam; ostioles conic-papillate; ascospores brown to dark brown, ellipsoid-inequilateral, 13.5-15.5 x 6-7.5 µm, with the straight germ slit spore-length or nearly so on the flattened side .... ***R. griseocincta***

9. Stromata globose, 1.5-2.2 mm diam, dark brown, with smooth surface; ascospores dark brown, fusoid-inequilateral, with narrowly rounded ends, 43-52 x 5.5-7(-8) µm, with the straight germ slit much less than spore-length on the flattened side .... ***R. arcuata***

9. Stromata less than 1.5 mm diam; ascospores less than 40 µm long 10

10. Stromata subglobose, 1-1.2 mm diam; ascospores brown, oblong ellipsoid-inequilateral, usually with pinched ends, 28-37 x 5.5-6.5(-7) µm, with the straight germ slit much less than spore-length on the flattened side, with a conspicuous hyaline sheath forming a papillate noncellular appendage at each end .... ***R. necatrix***

10. Stromata globose; ascospores usually without pinched ends, with the straight germ slit slightly less than spore-length always on the convex side 11

11. Stromata globose, 1.2-1.5 mm diam; ostioles conic-papillate to conical; ascospores dark brown to blackish brown, ellipsoid-inequilateral, (29-)31.5-35(-38) x 10-12 µm, with a conspicuous hyaline sheath, without a cellular appendage .... ***R. merrillii***

11. Stromata globose, 0.8-1.2 mm diam; ostioles conical; ascospores brown to dark brown, ellipsoid-inequilateral, (22.5-)23.5-30(-32) x 7-9 μm, with a conspicuous hyaline sheath and a cellular appendage only on one end..... ....***R. corticium***

KEY TO TAXA OF *STILBOHYPOXYLON* TREATED

1. Stromata subglobose, single or several coalesced, 1-2 mm diam x 1 mm high, with surface ornamented with brown to yellow scales; ostioles papillate, at center of slightly raised area; ascospores dark brown, short-fusoid, with narrowly rounded ends, 25-32.5 x 11-15 μm, with spiral germ slit less than spore-length .... ***S. quisquiliarum***
1. Stromata globose to subglobose, 0.5-0.8 mm diam, with smooth surface; ostioles papillate, not at center of raised area 2
   2. Ascospores brown to dark brown, fusoid, lacking slimy sheath, 12-16 x 5-6(-6.5) μm, with slightly oblique germ slit spore-length .... ***S**. sp.* (77062107)
   2. Stromata globose, 0.6-0.8 mm diam; ostioles slightly papillate; ascospores dark brown, ellipsoid-inequilateral, enclosed within thin, hyaline sheath which swell to form slimy caps on both ends, 18-21.5 x (7-)8-9 μm, with straight germ slit slightly less than spore-length...... .... ***S**. sp.* (75021102)

KEY TO TAXA OF *XYLARIA* TREATED

1. Stromata associated with termite nests; ascospores somewhat laterally flattened, 4.5-5 x 2.5-3.2 x 2-2.5 μm, with a poroid germination site.......... ....***X. melanaxis***
1. Stromata not associated with termite nests; ascospores larger 2
   2. Stromata growing on leaves..3
   2 Stromata growing on wood or stems 4
3. Stromata with rounded fertile part, with plaques on surface; ascospores brown, ellipsoid-inequilateral, with narrowly rounded ends, 10-12 x 4.5-5.5, with straight germ slit spore-length .... ***X**. sp.* (76072304)
3. Stromata with cylindrical fertile part, with striped outer peeling layer; ascospores brown to dark brown, ellipsoid-inequilateral, with narrowly rounded ends, 13.5-16.5 x 5-6 μm, with straight germ slit spore-length...... .... ***X**. sp.* (80082005)
   4. Fertile part clavate to irregular on short to long stipe, 4-12 cm total length x 1-3.5 cm diam, dark gray to blackish; ostioles often surrounded by sunken discs; ascospores 11-13.5 x 4-5 μm, with straight germ slit nearly spore-length to spore-length .... ***X. papulis***
   4. Ostioles not surrounded by sunken discs.......................................5
5. Stromata with an obtuse, fertile apex 6
5. Stromata with an acute or mucronate, sterile apex 31

6. Stromatal surface more or less smooth 7

6. Stromatal surface more or less roughened with cracks, perithecial contours, and coarse ostiolar papillae 18

7. Fertile part clavate to fusoid, on short to long stipe, 4.5-7.5 cm total length x 6-8 mm diam, dark brown; ostioles longitudinally arranged on the blackened area giving stromata a striped appearance; ascospores 10-12 x 4.5-5.5 µm, with straight germ slit spore-length .... ***X. grammica***

7. Combination of features differing from above 8

8. Stromata commonly associated with bamboos; fertile part cylindrical, unbranched or branched at base on short stout pubescent stipes, with narrowly rounded fertile apex, 1.5-2.5(-3.5) cm total length x 2-4 mm diam, ocher; surface smooth; ostioles papillate; asci with a flattened discoid apical ring; ascospores light brown, with broadly rounded ends, 8.5-10 x 3.5-4 µm, with straight germ slit much less than spore-length .... ***X. badia***

8. Stromata not associated with bamboos, with smooth stipes or with stipes highly reduced into narrow connective 9

9. Ascospores mostly less than 19 µm long 10

9. Ascospores mostly greater than 19 µm long 15

10. Ascospores ellipsoid or short-fusoid, nearly equilateral 11

10. Ascospores ellipsoid-inequilateral 12

11. Stromata discoid, 1-3 mm diam x 0.5-0.6 mm thick, with base narrowly attached to substrate; surface smooth, plane or with inconspicuous perithecial elevations; ascospores pale brown, with broadly rounded ends, 5-6 x 2-2.5 µm, with a very faint germ slit .... ***X. frustulosa***

11. Fertile part cylindrical, occasionally irregular, on very short stipe, 3-3.7 cm total length x 1.8-2.8 cm diam, dark copper brown to blackish brown, with surface smooth; ascospores brown, fusoid, (8.5-)9-10.5(-11) x 4-5 µm, with straight germ slit spore-length .... ***X. laevis***

12. Fertile part clavate on short stipe, 0.5-5 cm total length x 0.5-1.3 cm diam, or, infrequently, discoid, 2.5-7.5 mm diam x 1-1.5 mm thick, brown to dark brown; surface smooth or ornamented with network of fine cracks; ascospores blackish, 8-10.5 x 4-5 µm, mostly with very inconspicuous germ slit .... ***X. cubensis***

12. Ascospore germ slit usually conspicuous; combination of other features differing from above 13

13. Fertile part peltate to broadly obconical, with flattened top and a narrow central connection, 2-3 mm thick x 3-10 mm diam, dark brown to black; surface smooth except for a few irregular major cracks; ostioles papillate; ascospores blackish, with narrowly rounded to abruptly pinched ends, 11-13 x 5.5-7 µm, with straight germ slit less than spore-length .... ***X. berteri***

13. Fertile part cylindrical to clavate; combination of other features differing from above 14

14. Fertile part regularly cylindrical to clavate, on very short stipe, 5-13 cm total length x 8-15(-30) mm diam, either dark purplish brown or copper brown; ascospores brown, 12-15(-16) x 4-5 µm, with straight germ slit slightly less than spore-length .... ***X. allantoidea***

14. Ascospores 16-19 x 5.5-6.5 µm .... ***X. papyrifera***

15. Fertile part hemispherical, sessile, 4-8 mm diam x 2.5-4 mm high, black, overlain with white scales; ascospores 28-33 x 8.5-10 μm, with a noncellular, hyaline appendage 2-3 μm long on each end, with straight germ slit nearly spore-length .... ***X. areolata***
15. Fertile part clavate, ellipsoid, or obovoid, usually stipitate 16
    16. Fertile part clavate on short stipe, 7-12 cm total length x 1-2.5 cm diam, light ocher to orange brown, with hollow center; ascospores 18-22(-24) x 6-8 μm, with oblique germ slit much less than spore-length.. .... ***X. telfairii***
    16. Combination of features differing from above 17
17. Fertile part ellipsoid to obovoid on short to long stipe, 1-4 cm total length x 0.5-1.5 cm diam, dark brown; surface with finely reticulate cracks; ascospores ellipsoid-inequilateral, 20-24(-26) x 7-8 μm, with oblique germ slit much less than spore-length .... ***X. obovata***
17. Fertile part ellipsoid to broadly ellipsoid, on short stipe, 0.6-2 cm total length x 0.4-1.5 cm diam, blackish; surface with brown cracked outer layer; ascospores fusoid-inequilateral, (26-)28-32(-35) x 7-9 μm, with straight germ slit almost spore-length .... ***X.*** *sp.* (77080301)
    18. Ascospores mostly shorter than 15 μm.. 19
    18. Ascospores mostly longer than 15 μm.. 23
19. Stromata usually densely aggregated, pulvinate, bearing one to several perithecia; ascospores brown, broadly ellipsoid, with broadly rounded ends, (12-)13-15(-17) x 7.5-8.5(-9) μm, with long spiral germ slit.............. .... ***Xylaria*** *sp.* (77010712)
19. Ascospores with straight germ slit 20
    20. Fertile parts not aggregated into crust, clavate, flattened, on short stipes, 0.7-4.7 cm total length x 2.5-10 mm diam, dark brown to blackish, ornamented with conspicuous brownish to whitish scales; ostioles hemispherical; ascospores (8-)8.5-11 x 4-5 μm, with slightly less than spore-length germ slit.. ***X. curta***
    20. Fertile parts densely aggregated into crust, obconical to turbinate... 21
21. Stromata with yellow to orange tissue immediately beneath the surface; ascospores (9-)9.5-11 x 4.5-6 μm.................................. ***X. intracolorata***
21. Stromata lacking yellow to orange tissue.. 22
    22. Ascospores 11.5-12.5(-13.5) x 5.5-6.5(-7) μm .... ***X.*** *cf.* ***heliscus***
    22. Ascospores 9-11(-11.5) x 4-4.5 μm .... ***X. apoda***
23. Fertile part cylindrical to narrowly clavate, infrequently with sterile apex 24
23. Fertile part pulvinate, subglobose, ellipsoid to irregular, usually with fertile apex... 25
    24. Fertile part cylindrical, on short, smooth stipe, 8 cm total length x 5 mm diam, dark brown, with surface covered with narrowly striped peeling layer; ostioles hemispherical; ascospores reniform, with broadly rounded ends, 14-18 x 5-6(-6.5) μm, with spiral germ slit slightly less than spore-length .... ***X. leprosa***
    24. Fertile part cylindrical to narrowly clavate, on short to long tomentose stipe, 1.7-3.5 cm total length x 2-4.5 mm diam, blackish, the outer

surface with vertical cracking; ostioles hemispherical; ascospores ellipsoid-inequilateral, with narrowly rounded ends, occasionally abruptly pinched, 18-21(-22) x 6-7 µm, with short germ slit oblique to slightly spiral .... ***X. scruposa***

25. Ascospores frequently with abruptly pinched ends, dark brown to blackish 26

25. Ascospores mostly with narrowly rounded ends, dark brown 27

  26. Fertile part clavate on well-defined stipe, ca. 5 cm total length x 8 mm diam, dark brown; surface roughened with wrinkles and verrucae; ostioles hemispherical; ascospores 28-32 x 9-12 µm, with germ slit short, oblique .... ***X. formosana***

  26. Fertile part pulvinate to globose, with flattened to slightly convex top, on narrow central connective, 1.5-2(-3) mm high x 1-3 mm diam, dark brown to black; surface roughened with conspicuous reticulate cracks; ostioles hemispherical; ascospores 27-31 x 8-10 µm, with germ slit short, oblique .... ***X. glebulosa***

27. Stromata minute, pulvinate to narrowly cylindrical, usually less than 7 mm diam 28

27. Stromata robust, ellipsoid to clavate, usually more than 7 mm diam 29

  28. Fertile part subglobose to elongated, sessile or with short to long stipe, 0.2-5 cm x 1-7 mm diam, dark brown; surface with conspicuous perithecial contours and minute cracks; ostioles hemispherical; ascospores (21-)22-27(-30) x 7-9(-9.5) µm, with germ slit short, oblique to slightly spiral .... ***X. anisopleura***

  28. Fertile part pulvinate, on narrow central connection, 1.5-2 mm high x 1.5-3 mm diam, dark brown; surface roughened with fine cracks; ostioles faintly papillate; ascospores 19-23.5 x 6.5-7.5 µm, with germ slit short, oblique .... ***X. atrosphaerica***

29. Fertile part clavate, on short to long stipe, 5-11 cm total length x 8-12 mm diam, blackish; surface scabrous, roughened with major wrinkles and verrucae; ostioles hemispherical; ascospores 23-27(-30) x 7.5-9(-10) µm, with germ slit short, straight to somewhat oblique .... ***X. polymorpha***

29. Fertile part as above; surface with wrinkles or fine cracks, with a short, conspicuously oblique germ slit 30

  30. Stromata with solid interior; fertile part ellipsoid to clavate, on short to long stipe, 1.5-8 cm total length x 0.5-2.5 cm broad, dark brown to blackish; surface with wrinkles and fine cracks; ostioles usually faintly papillate; ascospores 20-25(-27) x 7-9 µm .... ***X. schweinitzii***

  30. Stromata with hollow interior; fertile part cylindrical to fusoid, flattened, on short stipes, up to 12 cm high x 3 cm broad, dull blackish; surface wrinkled, sometimes bearing remains of conidial pegs or with pits where conidial pegs detached; ostioles slightly raised; ascospores 17-21(-23) x 6-7.5 µm .... ***X. moelleroclavus***

31. Stromata with 1/3 to 1/2 perithecial profiles exposed 32

31. Stromata plane or with less than 1/3 perithecial profiles exposed 34

  32. Fertile part cylindrical, usually unbranched, with acute sterile apex, on slender pubescent stipe, 1-2.5 cm total length x 0.7-1 mm diam; surface roughened by perithecial contours, remnant of outer stromatal layer and sometimes stiff hairs; ostioles umbilicate; ascospores with narrowly rounded ends, 10-11.5 x (4-)4.5-5 µm, with straight germ slit almost spore-length .... ***X. schwackei***

32. Fertile part cylindrical, with sterile apex, on pubescent stipe, blackish; surface overlain with dark purplish brown hairs; ostioles faintly papillate 33

33. Ascospores with narrowly rounded ends, bearing a noncellular appendage on each end, 10-12 x 3.5-4.5 µm, with straight germ slit less than to slightly less than spore-length .... ***X. ianthinovelutina***

33. Ascospores with narrowly rounded ends, not bearing appendages, 15.5-19 x 5.5-6.5 µm, with straight to slightly oblique germ slit slightly less than spore-length .... ***X. juruensis***

34. Fertile part globose, subglobose to turbinate 35

34. Fertile part usually cylindrical 36

35. Fertile part subglobose to turbinate on narrow central connection, with obtuse sterile apex, 0.8-1 mm high x 1-1.5 mm diam, dark brown; surface smooth, with brown peeling layer; ostioles slightly raised, usually surrounded by a paler area; ascospores 17-19(-21) x 6.5-7.5 µm, with straight germ slit less than spore-length .... ***X. papillata***

35. Fertile part usually globose on short to long stalk, bearing mucronate apex, 1.7-12 mm total length x 1 mm diam, dark brown; surface undulate, with brown peeling layer; ostioles slightly raised; ascospores 20-25 x 8-9(-9.5) µm, with straight germ slit less than spore-length .... ***X. schreuderiana***

36. Stromata growing on monocot material; fertile part cylindrical, on short to long tomentose stipe, with acute sterile apex, 1.5-6(-9) cm total length x 1.5-2.5(-3.5) mm diam, dark brown; surface usually with evident perithecial contours and brown peeling layer; ostioles papillate; ascospores brown, with narrowly rounded ends, 9.5-11(-12.5) x 4-5 µm, with straight germ slit spore-length .... ***X. bambusicola***

36. Stromata growing on dicot material 37

37. Fertile part long cylindrical on short to long stipe, with acute sterile apex, 7-10(-14) cm total length x 2-3 mm diam, dark brown; surface undulate, with brown peeling layer; ostioles papillate; ascospores light brown, fusoid-inequilateral, usually with abruptly narrowed ends, 15-18(-20) x 4.8-5.5 µm, with straight germ slit much less than spore-length .... ***X. striata***

37. Fertile part usually less than 5 cm total length; ascospores brown to dark brown, ellipsoid-inequilateral 38

38. Stromata usually densely caespitose 39

38. Stromata usually solitary to a few associated 41

39. Fertile part fusoid to cylindrical on smooth slender stipe, with round to acute apex, 1.5-3.5 cm total length x 2-4 mm diam, blackish, early becoming hollow and inrolled; surface roughened by circumferential wrinkles; ostioles papillate; ascospores brown, fusoid-inequilateral to crescentic, 14-16.5 x 4.5-5.5(-6.5) µm, with straight germ slit less than spore-length .... ***X. fissilis***

39. Combination of features differing from above..40

40. Fertile part cylindrical, on short to long stipe, with obtuse to acute sterile apex, 1-3(-6) cm total length x 1-1.5(-3) mm diam, blackish; surface smooth to slightly undulate, with brown peeling layer; ostioles faintly papillate; ascospores brown, 10.5-12 x 4-4.5(-5) μm, with straight germ slit spore-length ....***X. multiplex***

40. Fertile part cylindrical, on slender pubescent stipe, usually with flattened sterile apex, blackish; surface evidently undulate, with brown peeling layer; ostioles finely conical; ascospores brown, (9.5-)10-11(-11.5) x 3.5-4.5 μm, with straight germ slit spore-length.... ....***X. consociata***

41. Fertile part overlain with striped peeling layer..42

41. Fertile part not overlain with striped peeling layer..................................44

42. Fertile part cylindrical, sessile to long stipitate, often bearing acute sterile apex, up to 3 cm total length x 1.5-3 mm diam, dark brown; surface with brown peeling layer; ostioles faint or slightly raised; ascospores with narrowly rounded ends, (12-)12.5-15.5 x 4.5-5.5(-6) μm, with straight germ slit much less than spore-length ....***X. arbuscula***

[NOTES: See also NOTES on ***X. arbuscula*** for its morphological variants.]

42. Ascospores usually greater than 16 μm long 43

43. Fertile part cylindrical, on short to long pubescent stipe, with acute sterile apex, 2.5-5 cm total length x 2-3.5 mm diam, dark brown; surface with brown peeling layer; ostioles faint; ascospores with narrowly rounded ends, 21-24.5(-26.5) x 7-9.5 μm, with straight germ slit slightly less than full length ....***X. apiculata***

43. Fertile part as above, 1-4.5 cm total length x 1.5-3 mm diam; ascospores with narrowly rounded ends, (15.5-)16-19 x 5.5-7 μm, with straight germ slit almost spore-length ....***X. arbuscula var. plenofissura***

44. Fertile part cylindrical, on short, smooth stipe, 8 cm total length x 5 mm diam, dark brown, with surface covered with narrowly striped peeling layer; ostioles hemispherical; ascospores reniform, with broadly rounded ends, 14-18 x 5-6(-6.5) μm, with spiral germ slit slightly less than spore-length ....***X. leprosa***

44. Fertile part cylindrical to narrowly clavate, on short to long tomentose stipe, 1.7-3.5 cm total length x 2-4.5 mm diam, blackish, the outer surface with vertical cracking; ostioles hemispherical; ascospores ellipsoid-inequilateral, with narrowly rounded ends, occasionally abruptly pinched, 18-21(-22) x 6-7 μm, with short germ slit oblique to slightly spiral ....***X. scruposa***

BISCOGNIAUXIA KUNTZE

Biscogniauxia capnodes (Berk. & Broome) Y.-M. Ju & J. D. Rogers, Mycotaxon 66: 23. 1998.

See Ju et al. (1998) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Hwa-lien Co., Tai-lu-ko, 30.III.1985, Ju, Y.-M., PPE-058, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 25.VI.1983, Ju, Y.-M., PPE-011, wood (JDR); I-lan Co., Yuan-shan, 1.XI.1987, Ju, Y.-M., 76110116, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 2.XI.1987, Ju, Y.-M., 76110201 (CULTURED), wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 23.III.1988, Ju, Y.-M., 77032301, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082028, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080721, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 28.XI.1987, Chang, C.-M., 76112801, wood (JDR); Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091010, wood (JDR); Tai-chung Co., Hsin-sei, 27.X.1987, Kuo, K.-J., 76102704, dead vines of ***Vitis vinifera*** (JDR); Tai-tung City, Lee-yu-shan, 21.V.1988, Hsieh, H.-M., 77052103, wood (JDR); Tainan Co., Hsin-hwa, 16.VII.1988, Hsieh, H.-M., 77071604, wood (JDR); Taipei City, Campus of National Taiwan Univ., 13.XI.1983, Ju, Y.-M., PPE-003, wood (JDR); Taipei City, Campus of National Taiwan Univ., 6.XI.1983, Ju, Y.-M., PPE-012, wood (JDR); Taipei City, Nei-hoo, 15.III.1988, Ju, Y.-M., 77031509, wood (JDR); Taipei City, Young-ming-shan, 8.I.1988, Chang, C.-M., 77010804, twigs of ***Leucaena glauca*** (JDR); Taipei Co., Shi-mann, 5.IV.1985, Jane, S.-T., PPE-060, wood (JDR); Taipei Co., Wu-lai, 15.V.1988, Ju, Y.-M., 77051502, wood (JDR).

NOTES: Ju and Tzean (1985a) reported this fungus in Taiwan as ***Hypoxylon nummularium*** Bull. *var.* ***pseudopachyloma*** (Speg.) J. H. Miller which is now considered to be a synonym of ***B. capnodes*** by Ju et al. (1998).

Biscogniauxia capnodes (Berk. & Broome) Y.-M. Ju & J. D. Rogers *var.* ***rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers, Mycotaxon 66: 27. 1998.

See Ju et al. (1998) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 11.X.1996, Ju, Y.-M., 85101103 (CULTURED), wood (JDR).

Biscogniauxia citriformis (Whalley, Hammelev, & Taligoola) Van der Gucht & Whalley, Mycol. Res. 96: 895. 1992.

See Ju et al. (1998) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091106 (CULTURED), wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: NIGERIA: Akure, Idanre Forest, VIII.1979, Taligoola, corticated wood (IMI 315971, HOLOTYPE of ***Hypoxylon citriforme***).

NOTES: A large-spored variety, ***macrospora***, was recently described by Van der Gucht and Whalley (1992) from Papua New Guinea.

Biscogniauxia philippinensis (Ricker) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990.

See Ju et al. (1998) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082011 (CULTURED), wood (JDR).

NOTES: The high ascal apical ring in ***B. philippinensis*** is unusual for a xylariaceous fungus that produces a ***Nodulisporium***-like anamorph. This feature is, however, commonly found in those xylariaceous fungi that produce ***Geniculosporium***-like anamorphs.

Biscogniauxia plana (Petch) Y.-M. Ju & J. D. Rogers, Mycotaxon 66: 48. 1998.

See Ju et al. (1998) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Taipei City, Campus of National Taiwan Univ., 2.III.1985, Ju, Y.-M., PPE-052, wood (JDR); Taipei City, Campus of National Taiwan Univ., 6.II.1988, Ju, Y.-M., 77020605 (CULTURED), dead wood of ***Cinnamomum camphora*** (JDR).

***Biscogniauxia** sp.* (80091405) Fig. 29

Stromata applanate, with rounded outlines, erumpent, 5-7 mm diam x ca. 0.6 mm thick; surface black, smooth; carbonaceous immediately beneath surface and between perithecia; tissue beneath the perithecial layer inconspicuous. Perithecia obovate, 0.2-0.3 mm diam x 0.4 mm high. Ostioles lower than the stromatal surface. Asci not intact, with apical ring bluing in Melzer's iodine reagent, discoid, 2.5-3 μm high x 6-6.5 μm broad. Ascospores blackish brown, unicellular, rectangular, nearly equilateral, with broadly rounded ends, smooth, 19.5-23 x (10-)11-13 μm, with straight germ slit slightly less than spore-length.

Colonies covering Petri dish in 2 wk, at first white, felty, azonate, with very diffuse margins, becoming olivaceous green from center outwards. Reverse green. Sporulating regions scattered over entire surface of colony, whitish to grayish. Conidiogenous structure with ***Periconiella***-like branching pattern as defined in Ju and Rogers (1996). Conidiophores hyaline to yellowish, roughened, composed of a main axis, 50-100 μm long x 3.5-4 μm broad, and sometimes one or more major branches, branches terminating with three to six conidiogenous cells arising in whorls from the main axis and/or from major branches or from additional subordinate branches; additional branches usually lacking or infrequently produced. Conidiogenous cells cylindrical, hyaline to yellowish, finely roughened, 8-17 x 3-4.5 μm, bearing poroid conidial secession scars on apical region, with apices becoming distorted from production of numerous conidia. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid, 5-7 x 3-3.5 μm, with flattened base indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091405 (CULTURED), wood (JDR).

NOTES: Cultures of this fungus are like those of ***B. capnodes***. This fungus differs from ***B. capnodes** var. **rumpens*** (Cooke) Y.-M. Ju & J. D. Rogers in having broader, rectangular ascospores, i.e., 19.5-23 x (10-)11-13 μm vs. (14-)15-22.5(-24) x 8-10.5 μm. The main axis of conidiophores is short, resembling that in ***Hypoxylon stygium***. This fungus appears to be an undescribed taxon. However, the material is scanty and is not adequate to be designated as a type.

Biscogniauxia uniapiculata (Penz. & Sacc.) Whalley & Laessøe *apud* Whalley, Laessøe, & Kile, Mycol. Res. 94: 239. 1990.

See Ju et al. (1998) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091014, wood (JDR); Taipei City, Chi-shinn-shan, 15.V.1984, Ju, Y.-M., PPE-019, wood (JDR); Taipei City, Young-ming-shan, 14.VII.1988, Ju, Y.-M., 77071406 (CULTURED), wood (JDR).

NOTES: Ju and Tzean (1985a) [as ***Hypoxylon uniapiculatum*** (Penz. & Sacc.) J. H. Miller] have recorded this taxon in Taiwan.

COLLODISCULA HINO & KATUMOTO

Collodiscula japonica Hino & Katumoto, Bull. Fac. Agric. Yamaguti Univ. 6: 55. 1955.

See Samuels et al. (1987) for a description of the teleomorph. The anamorph was described by Samuels et al. (1987) as ***Acanthodochium collodisculae*** Samuels, J. D. Rogers, & Nagasawa.

SPECIMEN EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082236, culms of ***Phyllostachys pubescens*** *var.* ***pubescens*** (JDR).

NOTES: This fungus is atypical for the Xylariaceae in having an ascospore with two equal cells that lack germ slits. It is still doubtful if it is really xylariaceous. However, its connection with the Xylariaceae via ***Rosellinia bambusae*** Henn. is obvious (Ju and Rogers, 1990). ***Collodiscula japonica*** was considered to belong to the Amphisphaeriaceae *sensu lato* by Samuels et al. (1987). The Amphisphaeriaceae is being redefined and may not ultimately include ***Collodiscula***.

CREOSPHAERIA THEISS.

Creosphaeria sassafras (Schwein.: Fr.) Y.-M. Ju, San Martín, & J. D. Rogers, Mycotaxon 47: 223. 1993.

The teleomorph is as described by Miller (1961) and Petrini and Müller (1986) [as ***Hypoxylon sassafras*** (Schwein.: Fr.) M. A. Curtis]. The anamorph is as described by Petrini and Müller (1986) and Ju et al. (1993).

SPECIMENS EXAMINED: Nan-tou Co., Huei-sun, 22.IV.1985, Ju, Y.-M., 74042201, wood (JDR); Taipei City, Young-ming-shan, 8.I.1988, Chang, C.-M., 77010801 (CULTURED), wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: U.S.A.: Pennsylvania, Bethlehem, Syn. 1200, Collins Coll. 33, corticated wood (PH, LECTOTYPE of ***Sphaeria sassafras***).

DALDINIA CES. & DE NOT.

Daldinia childiae J. D. Rogers & Y.-M. Ju, Mycotaxon 72: 512. 1999.

See Ju et al. (1997) [as ***D. concentrica***] and Rogers et al. (1999) for descriptions of the teleomorph. The anamorph was described by Ju et al. (1997) [as ***D. concentrica***].

SPECIMENS EXAMINED: Nan-tou Co., Lu-ku, Sun-linn-shi, 27.VII.1984, Ju, Y.-M., 73072706, wood (JDR); Tai-tung Co, Tzu-ben, 23.XII.1983, collector unknown, 72122301, wood (JDR); Tainan Co., Yon-kong, 5.IV.1984, Hsieh, H.-M., 73040501, wood (JDR).

NOTES: ***Daldinia childiae*** was treated as ***D. concentrica*** in Ju et al. (1997). Sawada (1959) reported ***D. concentrica*** from Taiwan. We have not seen his material and are uncertain about the identity of his fungus.

Daldinia eschscholzii (Ehrenb.) Rehm, Ann. Mycol. 2: 175. 1904.

See Child (1932) and Ju et al. (1997) for descriptions of the teleomorph. The anamorph was described by Ju et al. (1997).

SPECIMEN EXAMINED: Taipei City, Ta-tung-shan, V.1985, Ju, Y.-M., 74050001, wood (JDR).

NOTES: ***Daldinia eschscholzii*** differs from ***D. childiae*** primarily in having KOH-extractable stromatal pigments purplish or lacking and in having a plane stromatal surface.

HALOROSELLINIA WHALLEY, E. B. G. JONES, HYDE, & LAESSØE, *NOM. PROV.*

Halorosellinia oceanica (Schatz) Whalley, E. B. G. Jones, Hyde, & Laessøe, *nom. prov.* Fig. 52
≡ ***Hypoxylon oceanicum*** Schatz, Mycotaxon 33: 413. 1988.

Stromata erumpent from substrate, gregarious, enclosing one to several perithecia, conical to hemispherical, 1-2 mm long x 1-1.5 mm broad x ca. 1 mm high, blackish externally and internally. Perithecia spherical, 0.8-1 mm diam. Ostioles papillate, usually with a central umbilicate perforation, sometimes surrounded by an ocher-colored area. Asci eight-spored, cylindrical, stipitate, 150-165 μm total length x 15-16 μm broad, the spore-bearing part 120-130 μm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 6-7 μm high x 5.5-6 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid, often pinched at one end, 22.5-26(-28) x 11.5-13(-13.5) μm, with straight germ slit less than spore-length.

Colonies covering Petri dish in 4 wk, at first white, velvety, appressed, irregularly zonate, with dense, entire margins, then darkening on the zonation lines. Reverse uncolored. Stroma-like pustules produced on the zonation lines, pulvinate, up 1 mm diam x 0.8 mm high, pinkish at first, blackened from base upwards. Sporulating regions on the upper surface of stromata and on surface of colonies in small tufts independent of stromata. Conidiophores in upright dense palisades, dichotomously branched several times from base, sinuous, smooth, olivaceous. Conidiogenous cells terminal, cylindrical, 10-15 x 2.5-3 μm, conspicuously geniculate, smooth-walled, bearing faint conidial secession scars on the twisted points. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (whitish in masses), smooth, obovate, (4-)4.5-5.5(-6) x 2-3 μm, with flattened base 1-1.5 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: Taipei Co., Tam-shui, Chu-wei, 16.XI.1988, Chang, H.-S., 77111601 (CULTURED), decorticated wood in mangrove forest (JDR).

ADDITIONAL SPECIMEN EXAMINED: U.S.A.: Florida, Dania, J.B. Lloyd State Park, 25.IV.1986, Schatz, S. FLA-16, ***Rhizophora mangle*** (JDR, ISOTYPE of ***Hypoxylon oceanicum***).

NOTES: This material is much the same as the isotype at JDR except for its shorter ascal stipes. The teleomorph of this fungus is similar to that of ***Stilbohypoxylon quisquiliarum***. Schatz (1988) originally reported this fungus with ascospores 18.75-25 x 7.5-11.25 μm. The ascospore size range of the Taiwan collection, 22.5-26(-28) x 11.5-13(-13.5) μm, is close to that of isotype material, 21-26 x 10-12 μm, but wider than that given by Schatz. The contrast between the teleomorphs of ***H. oceanica*** and ***S. quisquiliarum*** was amplified by the data obtained from cultures. The former has narrower conidiophores and much smaller conidia than the latter. The conidiogenous cells of ***H. oceanica*** are strongly geniculate and have very faint conidial secession scars, whereas those of ***S. quisquiliarum*** are smooth and have denticulate conidial secession scars. Moreover, ***Stilbohypoxylon quisquiliarum*** produced yellow mycelia and distinct synnemata in culture but ***H. oceanica*** did not. Whalley et al. (1994) recently reported this fungus from Malaysia and South East Asia and stated that it "has been reported from most countries which have a suitable mangrove community."

HYPOXYLON BULL.

Hypoxylon annulatum (Schwein.: Fr.) Mont. *apud* C. Gay, Fl. Chilena VII, p. 445. 1850.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 5.IX.1987, Ju, Y.-M., 76090505, wood (JDR); Taipei City, Nei-hoo, 15.III.1988, Ju, Y.-M., 77031503 (CULTURED), wood (JDR); Taipei City, Young-ming-shan, 8.I.1988, Chang, C.-M., 77010807, wood (JDR); Taipei City, Young-ming-shan, 8.I.1988, Chang, C.-M., 77010802, wood (JDR); Taipei Co., Shi-mann, 5.IV.1985, Jane, S.-T., PPE-062, wood (JDR).

NOTES: Ju and Tzean (1985a), following the monograph of Miller (1961), included collections of this fungus under ***H. truncatum*** (Schwein.: Fr.) J. H. Miller.

Hypoxylon atroroseum J. D. Rogers, Canad. J. Bot. 59: 1363. 1981.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Taipei City, Campus of National Taiwan Univ., 20.I.1988, Ju, Y.-M., 77012003 (CULTURED), wood of ***Ficus*** (JDR).

Hypoxylon bovei Speg. *var.* ***microspora*** J. H. Miller, A Monograph of the World Species of ***Hypoxylon***, p. 95. 1961.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 27.VI.1984, Ju, Y.-M., PPE-018, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 11.X.1996, Ju, Y.-M., 85101105, wood (JDR); Nan-tou Co., Ho-sei, 27.X.1979, collector unknown, 68102701, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082217, wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 27.VII.1984, Ju, Y.-M., PPE-033, wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 27.VII.1984, Ju, Y.-M., PPE-026, wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 27.VII.1984, Ju, Y.-M., PPE-025, wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 19.VIII.1988, Ju, Y.-M., 77081901 (CULTURED), wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080717, wood (JDR); Ping-tung Co., Heng-chun, Kong-ko, 24.VIII.1988, Ju, Y.-M., 77082412, wood (JDR); Tai-tung Co, Tzu-ben, 2.VI.1982, collector unknown, 71060202, wood (JDR); Taipei City, Nei-hoo, 15.III.1988, Ju, Y.-M., 77031508, wood (JDR); Taipei City, Nei-hoo, 10.VII.1987, Ju, Y.-M., 76071004, wood (JDR).

NOTES: This fungus has been reported in Taiwan by Ju and Tzean (1985a). Most collections of this fungus that we have seen are from Asia. The above-cited specimens are typical of this taxon. Collection 76071201 [Nan-tou Co., Hsin-yi, Pa-tong-gwang, 12.VII.1987, Yeh, T.-Y. (CULTURED), dead wood (JDR)] largely agrees with ***H. bovei*** *var.* ***microspora*** except for having larger perithecia 1-1.3 mm diam.

Hypoxylon brevisporum Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 92. 1996.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082326 (CULTURED), wood (WSP, HOLOTYPE of ***Hypoxylon brevisporum***).

Hypoxylon cinnabarinum (Henn.) Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 99. 1996.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091103 (CULTURED), wood (JDR).

Hypoxylon cohaerens (Pers.: Fr.) Fr. *var.* ***microsporum*** J. D. Rogers & Candoussau, Mycologia 72: 826. 1980.

See Rogers and Candoussau (1980) and Ju and Rogers (1996) for descriptions of the teleomorph. Rogers and Candoussau (1980) have described the anamorph.

SPECIMEN EXAMINED: Nan-tou Co., Mei-fong, VI.1985, Ju, Y.-M., 74060001, wood (JDR).

Hypoxylon crocopeplum Berk. & M. A. Curtis *apud* Berk., Grevillea 4: 49. 1875.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082311 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Kong-ko, 24.VIII.1988, Ju, Y.-M., 77082405 (CULTURED), wood (JDR); Tainan Co., Nan-hsi, 24.IX.1984, Ju, Y.-M., PPE-038, wood (JDR).

NOTES: Typical collections of ***H. crocopeplum*** found in eastern North America usually have spherical perithecia. The Taiwan collections, however, have tubular perithecia. The collection PPE-038 in Ju and Tzean (1985a) was treated as ***H. hypomiltum*** Mont. by following Miller's concept (1961).

Hypoxylon duranii J. D. Rogers, Mycotaxon 23: 429. 1985.

See Rogers (1985) and Ju and Rogers (1996) for descriptions of the teleomorph. Ju and Rogers (1996) have described the anamorph.

SPECIMEN EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082006 (CULTURED), wood (JDR).

Hypoxylon fendleri Berk. *ex* Cooke, Grevillea 11: 132. 1883.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091117, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091113 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082316 (CULTURED), wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052012, wood (JDR).

Hypoxylon fuscum (Pers.: Fr.) Fr., Summa Veg. Scand. II, p. 384. 1849.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Hsin-chu Co., Chien-shih, Ta-ba-chien-shan, 25.VIII.1988, Yeh, T.-Y., 77082502, fallen branch of ***Alnus formosana*** (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091402 (CULTURED), wood (JDR); Nan-tou Co., Hsin-yi, Pa-tong-gwang, 7.I.1988, Ju, Y.-M., 77010704, fallen branch of ***Alnus formosana*** (JDR); Nan-tou Co., Hsin-yi, Pa-tong-gwang, VII.1982, collector unknown, 71070001, wood (JDR); Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091006, wood (JDR); Tao-yuan Co., Fu-hsin, La-la-shan, 3.VIII.1988, Ho, S.-M., 77080303 (CULTURED), fallen branch of ***Alnus formosana*** (JDR).

NOTES: Those collections from low altitudes have larger ascospores and are probably not associated with ***Alnus***. Nonetheless, their cultures are identical to those isolated from collections that were made from ***Alnus***.

Hypoxylon haematostroma Mont. *apud* Sagra, Hist. Phys. Pol. Nat. Cuba IX, p. 344. 1845.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082327 (CULTURED), wood (JDR).

Hypoxylon hypomiltum Mont., Ann. Sci. Nat. Bot., sér. II, 13: 356. 1840.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082004 (CULTURED), wood (JDR).

NOTES: The collection (PPE-038) of ***H. hypomiltum*** listed in Ju and Tzean (1985a) is now considered to be ***H. crocopeplum***.

Hypoxylon ilanense Y.-M. Ju & J. D. Rogers, *sp. nov.* Figs. 1, 2, 30

Etymology: After I-lan County, Taiwan

Stromata late effusa, tumulis peritheciorum conspicue exsertis, usque ad 10 cm longa x 6 cm lata x ca. 0.7 mm crassa; externe rufobrunnea postea atra, plerumque pruina vel granulo praedita; sub superficie strato rubigineobrunneo exili praedita; pigmentis lateritis in KOH dissolutis; textura inter perithecia carbonacea et sub peritheciis inconspicua. Perithecia globosa, 0.4-0.6 mm diam. Ostiola papillata disco 0.1 mm diam cincta, plerumque substantia alba superata. Asci 95-110 μm longitudine tota x 3.5-4.5 μm crassi, partibus sporiferis 45-55 μm longitudine, stipitibus 50-60 μm longitudine, annulo apicali in liquore iodato Melzeri cyanescente, discoideo, 0.5-1 μm alto x 2 μm lato. Ascosporae brunneolae vel brunneae, unicellulares, ellipsoideo-inequilaterales apicibus angustatis, 5.5-6 x 2.5-3 μm, rima germinativa recta longa in latere convexo praeditae; perisporium in KOH dehiscens, leve, area incrassata in latere convexo praedita; episporium leve.

Stromata widely effused, with perithecial mounds 1/2 to entirely exposed (rosellinioid), up to 10 cm long x 6 cm broad x ca. 0.7 mm thick; surface dull copper brown when young, becoming black, usually pruinose or granulose; thin, dull rusty brown tissue immediately beneath surface, with brick (59) KOH-extractable pigments; carbonaceous layer discretely enclosing individual perithecia; the tissue beneath perithecial layer inconspicuous. Perithecia spherical, 0.4-0.6 mm diam. Ostioles papillate, encircled with indistinct or distinct ***truncatum***-type disc as defined in Ju and Rogers (1996), 0.1 mm diam, usually overlain with white substance. Asci 95-110 μm total length x 3.5-4 .5 μm broad, the spore-bearing parts 45-55 μm long, the stipes 50-60 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 0.5-1 μm high x 2 μm broad. Ascospores light brown to brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 5.5-6 x 2.5-3 μm, with straight germ slit spore-length on the convex side; perispore dehiscent in 10% KOH, smooth, with thickened area visible at position of ca. 1/3 ascospore length on the same side as germ slit; epispore smooth.

Colonies covering Petri dish in 3 wk, at first white, becoming buff (45), with scattered hazel (88) patches, velvety, azonate, with diffuse margins; reverse uncolored. Sporulation lacking on OA and scarcely on SMEA near the inoculation blocks. Conidiogenous structure ***Virgariella***-like as defined in Ju and Rogers (1996), pale brown, roughened. Conidiogenous cells hyaline, finely roughened, 17-33 x 2.5-3.5 μm. Conidia hyaline, smooth, ellipsoid, 4-5 x 2-3 μm.

SPECIMEN EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 11.X.1996, Ju, Y.-M., 85101101 (CULTURED), wood (WSP, HOLOTYPE of ***Hypoxylon ilanense***).

NOTES: This fungus belongs to ***Hypoxylon*** section ***Annulata***. It is characterized by conspicuous perithecial mounds, small ostiolar discs, brick-colored KOH-extractable pigments, and small ascospores.

Hypoxylon investiens (Schwein.) M. A. Curtis, Geol. Nat. Hist. Surv. North Carolina, pt. III, p. 140. 1867.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091005, wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052004 (CULTURED), wood (JDR).

Hypoxylon lenormandii Berk. & M. A. Curtis *apud* Berk., J. Linn. Soc., Bot. 10: 385. 1869.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091104 (CULTURED), wood (JDR).

Hypoxylon lienhwacheense Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 143. 1996.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M, 77080710 (CULTURED), wood (WSP, HOLOTYPE of ***Hypoxylon lienhwacheense***).

NOTES: This fungus has also been collected from Papua New Guinea recently (Van der Gucht et al., 1997).

Hypoxylon lividicolor Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 144. 1996.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082007 (CULTURED), wood (WSP, HOLOTYPE of ***Hypoxylon lividicolor***).

Hypoxylon monticulosum Mont., Syll. Gen. Sp. Crypt., p. 214. 1856.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 5.IX.1987, Ju, Y.-M., 76090506, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 27.VII.1984, Ju, Y.-M., PPE-046, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080720, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-041, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091109, wood (JDR); Ping-tung Co., Heng-chun, Kong-ko, 24.VIII.1988, Ju, Y.-M., 77082407, wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052003, wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052011, wood (JDR); Tai-tung Co., Tai-ma-lee, Mei-ho, 29.XII.1986, Ju, Y.-M., 75122901, wood (JDR); Tainan Co., Yon-kong, 16.VII.1988, Hsieh, H.-M., 77071603, wood (JDR); Taipei City, Campus of National Taiwan Univ., 2.III.1985, Ju, Y.-M., PPE-053, wood (JDR); Taipei City, Campus of National Taiwan Univ., 6.II.1988, Ju, Y.-M., 77020601, wood (JDR); Taipei City, Campus of National Taiwan Univ., 2.III.1988, Ju, Y.-M., 77030201, wood (JDR); Taipei City, Campus of National Taiwan Univ., 19.VIII.1987, Ju, Y.-M., 76081903, wood (JDR); Taipei City, Campus of National Taiwan Univ., 29.X.1983, Ju, Y.-M., PPE-002, wood (JDR); Taipei City, Nei-hoo, 15.III.1988, Ju, Y.-M., 77031504, wood (JDR); Taipei City, Nei-hoo, 10.VII.1988, Ju, Y.-M., 77071002, wood (JDR); Taipei City, Young-ming-shan, 14.VII.1988, Ju, Y.-M., 77071405, wood (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062113, wood (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062109 (CULTURED), wood (JDR).

NOTES: Ju and Tzean (1985a) reported this fungus as ***H. multiforme*** (Fr.: Fr.) Fr. which has larger perithecia and a less than spore-length germ slit on the ascospore. Moreover, ***Hypoxylon monticulosum*** lacks a carbonaceous stromatal layer enclosing individual perithecia and a thickening on the ascospore perispore.

Hypoxylon moriforme Henn., Bot. Jahrb. Syst. 23: 287. 1896.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Chia-yi Co., Gwang-tsu-linn, 25.III.1988, Hsieh, H.-M., 77032501 (CULTURED), wood (JDR); Nan-tou Co., Huei-sun, 22.IV.1985, Ju, Y.-M., PPE-055, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080708 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082318 (CULTURED), wood (JDR).

NOTES: Ju and Tzean (1985a), following the monograph of Miller (1961), included collections of this fungus under ***H. truncatum*** (Schwein.: Fr.) J. H. Miller.

Hypoxylon moriforme Henn. *var.* ***microdiscus*** Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 217. 1996.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Hwa-lien Co., Tai-lu-ko, 30.III.1985, Ju, Y.-M., 74033001, wood (JDR); Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091008 (CULTURED), wood (WSP, HOLOTYPE of ***Hypoxylon moriforme*** *var.* ***microdiscus***); Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091003 (CULTURED), wood (JDR).

Hypoxylon musceum J. D. Rogers, Canad. J. Bot. 59: 1363. 1981.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082317, wood (JDR).

Hypoxylon nitens (Ces.) Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 220. 1996.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 8.III.1985, Ju, Y.-M., PPE-040, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 11.X.1996, Ju, Y.-M., 85101106, wood (JDR); Nan-tou Co., Huei-sun, 9.X.1987, Ju, Y.-M., 76100909, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 19.XI.1983, Ju, Y.-M., PPE-045, wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 27.VII.1984, Ju, Y.-M., PPE-032, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080709 (CULTURED), wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 14.I.1988, Ju, Y.-M., 77011401 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072333, wood (JDR); Tai-tung Co., Tai-ma-lee, Mei-ho, 29.XII.1986, Ju, Y.-M., 75122902, wood (JDR); Taipei City, Campus of National Taiwan Univ., 19.IV.1988, Ju, Y.-M., 77041901 (CULTURED), wood (JDR); Taipei City, Nei-hoo, 10.VII.1987, Ju, Y.-M., 76071001 (CULTURED), wood (JDR); Taipei Co., Pinglin, 4.III.1984, Jane, S.-T., PPE-010, wood (JDR).

NOTES: Ju and Tzean (1985a), following the monograph of Miller (1961), included collections of this fungus under ***H. truncatum*** (Schwein.: Fr.) J. H. Miller.

Hypoxylon notatum Berk. & M. A. Curtis *apud* Berk., Grevillea 4: 50. 1875.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091407 (CULTURED), twigs (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082003 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 26.XI.1987, Ju, Y.-M., 76112604 (CULTURED), twigs (JDR).

Hypoxylon parksianum Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 162. 1996.

See Ju and Rogers (1996) for a description of the teleomorph.

SPECIMEN EXAMINED: locality unknown, collector unknown, wood (JDR).

Hypoxylon perforatum (Schwein.: Fr.) Fr., Summa Veg. Scand. II, p. 384. 1849.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Chia-yi Co., Wu-fong, A-lee-shan, 24.VII.1988, Hsieh, H.-M., 77072410 (CULTURED), wood (JDR); Hwa-lien Co., Hsing-chen, 30.III.1985, Ju, Y.-M., PPE-020, culm of bamboo (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 27.VI.1984, Ju, Y.-M., PPE-015, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082212 (CULTURED), wood (JDR); Taipei City, Campus of National Taiwan Univ., 16.I.1988, Ju, Y.-M., 77011601 (CULTURED), wood of ***Ficus virgata*** (JDR).

NOTES: ***Hypoxylon perforatum*** was considered to be a synonym of ***H. rubiginosum*** (Pers.: Fr.) Fr. by Miller (1961). Ju and Tzean (1985a) recorded this fungus in Taiwan under ***H. rubiginosum***.

Hypoxylon pilgerianum Henn., Hedwigia 39: 138. 1900.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Yuan-shan, 1.XI.1987, Ju, Y.-M., 76110108 (CULTURED), culms of ***Dendrocalamus latiflorus*** (JDR); Nan-tou Co., Lu-ku, Shi-tou, 27.VII.1984, Ju, Y.-M., PPE-048, culms of bamboo (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080718 (CULTURED), culms of bamboo (JDR); Tai-chung City, 12.II.1988, Ju, Y.-M., 77021201, culms of bamboo (JDR); Taipei City, Campus of National Taiwan Univ., 25.XI.1987, Ju, Y.-M., 76112501, culms of bamboo (JDR); Taipei City, Campus of National Taiwan Univ., 8.XI.1987, Ju, Y.-M., 76110803 (CULTURED), culms of bamboo (JDR); Taipei City, Campus of National Taiwan Univ., 3.X.1987, Ju, Y.-M., 76100301 (CULTURED), culms of bamboo (JDR); Tao-yuan Co., Fu-hsin, La-la-shan, 3.VIII.1988, Ju, Y.-M., 77080308 (CULTURED), culms of bamboo (JDR).

Hypoxylon retpela Van der Gucht & Van der Veken, Mycotaxon 44: 283. 1992.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091102 (CULTURED), wood (JDR).

Hypoxylon rutilum Tul. & C. Tul., Sel. Fung. Carp. II, p. 38. 1863.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Nan-tou Co., Hsin-yi, Pa-tong-gwang, 7.I.1988, Ju, Y.-M., 77010706, wood (JDR); Yue-shan National Park, 2200 m elev., 13.X.1993, Wang, Y.-Z. 32, 82101301 (CULTURED), wood (JDR).

Hypoxylon *sp.* (77082404) Fig. 46

It differs from ***H. anthochroum*** in having smaller perithecia, 0.1-0.2 mm diam x 0.3-0.4 mm high. The colonies are much like those of ***H. anthochroum*** but the conidiogenous structure is ***Periconiella***-like rather than ***Nodulisporium***-like.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Kong-ko, 24.VIII.1988, Ju, Y.-M., 77082404 (CULTURED), wood (JDR).

NOTES: This fungus has been discussed by Ju and Rogers (1996) in NOTES on ***H. anthochroum***.

Hypoxylon *sp.* (80091101)

It is like ***H. anthochroum*** in both the teleomorph and anamorph except for having smaller perithecia, 0.1-0.2 mm diam x 0.4 mm high, having slightly larger ascospores, 12-14(-15) x 6-7 μm, having longer ascal stipes, 115-135 μm long, and having smoke gray (105) sporulating regions on colonies.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091101 (CULTURED), wood (JDR).

NOTES: This fungus has been discussed by Ju and Rogers (1996) in NOTES on ***H. anthochroum***.

Hypoxylon *sp.* (80091401)

See Ju and Rogers (1996) [as ***H***. sp. Ju 80091401] for descriptions of the teleomorph and anamorphs.

SPECIMEN EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091401 (CULTURED), wood (JDR).

Hypoxylon stygium (Lév.) Sacc., Syll. Fung. I, p. 379. 1882.

See Miller (1961) and Ju and Rogers (1996) for descriptions of the teleomorph. Ju and Rogers (1996) have described the anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 8.III.1985, Ju, Y.-M., PPE-039, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091422, wood (JDR); Nan-tou Co., Huei-sun, 9.X.1987, Ju, Y.-M., 76100905, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072313 (CULTURED), wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 19.V.1988, Hsieh, H.-M., 77051901 (CULTURED), wood (JDR); Taipei City, Campus of National Taiwan Univ., 6.XI.1983, Ju, Y.-M., PPE-005, wood (JDR); Taipei City, Nan-kong, 23.XI.1987, Ju, Y.-M., 76112303, wood (JDR); Taipei City, Nei-hoo, 15.III.1988, Ju, Y.-M., 77031505, wood (JDR); Taipei City, Ta-tung-shan, 1985, Ju, Y.-M., PPE-189, wood (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062116, wood (JDR); Tao-yuan Co., Fu-hsin, La-la-shan, 3.VIII.1988, Ho, S.-M., 77080306, wood (JDR).

NOTES: Ju and Tzean (1985a) have previously reported this fungus in Taiwan.

Hypoxylon subgilvum Berk. & Broome, J. Linn. Soc., Bot. 14: 120. 1873.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-049, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091118, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082312 (CULTURED), wood (JDR); Taipei City, Campus of National Taiwan Univ., 2.III.1988, Ju, Y.-M., 77030202 (CULTURED), wood of ***Ficus*** (JDR).

Hypoxylon subgilvum Berk. & Broome *var.* ***microsporum*** (Abe) Y.-M. Ju & J. D. Rogers

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082324 (CULTURED), twigs (JDR).

Hypoxylon trugodes Berk. & Broome, J. Linn. Soc., Bot. 14: 122. 1873.

See Ju and Rogers (1996) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082002, wood (JDR); Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091001 (CULTURED), 80091002, 80091004, wood (JDR); Tai-chung City, 16.XII.1987, Ju, Y.-M., 76121601 (CULTURED), wood (JDR).

Hypoxylon urceolatum (Rehm Y.-M. Ju & J. D. Rogers, A Revision of the Genus ***Hypoxylon***, p. 232. 1996.

See Ju and Rogers (1996) for a description of the teleomorph.

SPECIMEN EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 8.III.1985, Ju, Y.-M., PPE-030, wood (JDR).

NOTES: Following Miller's (1961) concept, Ju and Tzean (1985a) identified the cited specimen as ***H. truncatum*** (Schwein.: Fr.) *var.* ***pouceanum*** (Berk. & Cooke) J. H. Miller which is now accepted as ***H. pouceanum*** Berk. & Cooke (Ju and Rogers, 1996). ***Hypoxylon urceolatum*** differs from ***H. pouceanum*** in having pale, non-flattened ascospores and in having a short germ slit extending from only one end of the ascospore.

KRETZSCHMARIA FR.

Kretzschmaria neocaledonica (Har. & Pat.) J. D. Rogers & Y.-M. Ju, Mycotaxon 68: 363. 1998.

See Rogers and Ju (1998) for a description of the teleomorph.

SPECIMEN EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 27.VII.1984, Ju, Y.-M., 73072702, wood (JDR).

Kretzschmaria pavimentosa (Ces.) P. Martin, J. S. African Bot. 42: 74. 1976.

See Rogers and Ju (1998) for a description of the teleomorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091412, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 16.X.1997, Wang, Y.-Z. 511, 86101601 (CULTURED), wood (JDR).

Kretzschmaria zonata (Lév.) P. Martin, J. S. African Bot. 42: 75. 1976.

See Rogers and Ju (1998) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082304 (CULTURED), root of ***Ficus*** (JDR).

NEMANIA S. F. GRAY

Nemania atropurpurea (Fr.: Fr.) Pouzar, Česká Mykol. 39: 19. 1985.

Stromata effused-pulvinate, containing a number of perithecia, with sloping margins, 1-2.5 cm long x 0.7-1.2 cm broad x 0.7-1 mm thick; surface blackish brown, with conspicuous to inconspicuous perithecial mounds; carbonaceous immediately beneath surface and between perithecia; the tissue beneath perithecial layer inconspicuous. Perithecia spherical, 0.7-0.9 mm diam. Ostioles papillate. Asci eight-spored, cylindrical, stipitate, 160-210 μm total length x 6-7 μm broad, the spore-bearing part 70-80 μm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 2.5-3 μm high x 2.5 μm broad. Ascospores light brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 10-12 x 4.5-5 μm, with inconspicuous, straight germ slit much less than spore-length on flattened side.

Petrini and Rogers (1986) [as ***Hypoxylon atropurpureum*** (Fr.: Fr.) Fr.] have described the anamorph.

SPECIMEN EXAMINED: Tao-yuan Co., Fu-hsin, La-la-shan, 12.II.1987, Ju, Y.-M., 76021201, wood (JDR).

ADDITIONAL SPECIMENS EXAMINED: SWEDEN: Fries, Scler. Suec. Exs. 75, *ex* Herb. Strasbourg (BPI, TYPE of ***Sphaeria atropurpurea***); Fries, Scler. Suec. Exs. 75, *ex* Herb. Schwein. (BPI, TYPE of ***Sphaeria atropurpurea***).

NOTES: ***Nemania atropurpurea*** is a member of the ***N. serpens*** complex. It can be differentiated from the rest of this complex by its light brown ascospores, 10-12 x 4.5-5 μm, with narrowly rounded ends and a short germ slit. Unfortunately, we did not obtain cultures from the Taiwan collection. This fungus is known mainly from northern temperate regions. Van der Gucht (1995) recently recorded it from Papua New Guinea.

Nemania bipapillata (Berk. & M. A. Curtis) Pouzar, Česká Mykol. 39: 24. 1985. Fig. 48

≡ ***Hypoxylon bipapillatum*** Berk. & M. A. Curtis *apud* Berk., J. Acad. Nat. Sci. Philadelphia, ser. II, 2: 285. 1853.

= ***Hypoxylon subannulatum*** Henn. & E. Nyman *sensu* J. H. Miller, A Monograph of the World Species of ***Hypoxylon***, p. 95. 1961.

≡ ***Nemania subannulata*** (Henn. & E. Nyman) Y. Abe & Z. L. Liu, Bull. Nat. Sci. Mus. Tokyo, ser. B. (Bot.) 21: 80. 1995.

= ***Hypoxylon freycinetiae*** Rehm, Leafl. Philipp. Bot. 8: 2959. 1916.

≡ ***Astrocystis freycinetiae*** (Rehm) K. D. Hyde, Sydowia 49: 2. 1997.

Stromata, perithecia, and ostioles are as described in Miller (1961) [as ***Hypoxylon subannulatum*** Henn. & E. Nym.]. Asci eight-spored, cylindrical, stipitate, 190-225 μm total length x 6.5-8 μm broad, the spore-bearing part 80-90 μm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 3-3.5 μm high x 2.5 μm broad. Ascospores dark brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 10.5-13.5 x 4.5-6 μm, with straight germ slit spore-length on flattened side.

Colonies covering Petri dish in 2-2.5 wk, at first white, floccose, azonate, with fimbriate margins, becoming underlain with irregular black patches. Reverse uncolored. Conidium-bearing structures produced over entire surface of colonies. Conidiophores erect, di- or trichotomously branched, without a well-defined main axis, 2.5-3 μm broad at base, hyaline, smooth, sometimes associated with heavily encrusted hyphae. Conidiogenous cells proliferating indeterminately, cylindrical, geniculate, 2-2.5(-3) μm broad, hyaline, smooth-walled, bearing terminal and lateral poroid conidial secession scars 0.5 μm diam. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (grayish collectively), smooth, subglobose to ellipsoid, 3.5-5.5(-6) x 2.5-3.2 μm, with flattened base 0.7 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 9.XI.1983, Ju, Y.-M., PPE-001, wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 27.VII.1984, Ju, Y.-M., PPE-027, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080714 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-042, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082334, wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052006, wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052005, dead stem of palm (JDR); Taipei City, Campus of National Taiwan Univ., 2.III.1985, Ju, Y.-M., PPE-050, wood (JDR); Taipei City, Campus of National Taiwan Univ., 6.XI.1983, Ju, Y.-M., PPE-004, wood (JDR); Taipei City, Chi-shinn-shan, 15.V.1984, Ju, Y.-M., 73051502, wood (JDR); Taipei City, Ta-tung-shan, 1985, Ju, Y.-M., PPE-188, wood (JDR); Taipei City, Young-ming-shan, 14.VII.1988, Ju, Y.-M., 77071401 (CULTURED), wood (JDR); Taipei City, Young-ming-shan, 8.VII.1987, Ju, Y.-M., 76070801, wood (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062106, wood (JDR).

ADDITIONAL SPECIMENS EXAMINED: PHILIPPINES: summit of Mt. Maquiling, 1.I.1914, Baker, C.F. 3416, decorticated twigs of ***Freycinetia*** (S, HOLOTYPE of ***Hypoxylon freycinetiae***). SURINAM: Exot. fung. 58, as

Sphaeria colliculosa by Schweinitz, L.V.D. (PH, HOLOTYPE of ***Hypoxylon bipapillatum***).

NOTES: The type material of ***Hypoxylon bipapillatum*** at PH has a small disc encircling each ostiole. Miller's interpretation of ***H. subannulatum*** Henn. & E. Nyman, which does not seem to have an extant type, is the same as ***H. bipapillatum***. The concept of Pouzar (1985) and Petrini and Rogers (1986) on ***Nemania bipapillata*** is equivalent to ***N. diffusa***. Miller (1961) placed ***H. subannulatum*** in ***Hypoxylon*** section ***Annulata*** due to the presence of a small disc encircling the ostiole. In culture, ***Nemania bipapillata*** produced an anamorph referable to ***Geniculosporium*** which has usually been connected with the ***N. serpens*** complex and some ***Rosellinia*** species. Anamorphs of taxa in Miller's ***Hypoxylon*** section ***Annulata*** are ***Nodulisporium***-like.

This fungus has been reported in Taiwan by Ju and Tzean (1985a) [as ***Hypoxylon subannulatum***].

Nemania diffusa (Sowerby) S. F. Gray, Nat. Arr. Brit. Pl., p. 517. 1821.
≡ ***Sphaeria diffusa*** Sowerby, Col. Fig. Engl. Fung. III, Pl. 373, Fig. 10. 1803; *non* Schwein., 1832.
= ***Hypoxylon irregulare*** Cooke, Grevillea 11: 133. 1883.
= ***Hypoxylon lilacinofuscum*** Bres., Fl. Trident. Nov. II, p. 43. 1892.
= ***Hypoxylon cohaerens*** (Pers.: Fr.) Fr. *var.* ***brasiliense*** Starb., Bih. Kongl. Svenska Vetensk-Akad. Handl. 27, 3: 8. 1901.
= ***Hypoxylon vestitum*** Petch, Ann. Roy. Bot. Gard. (Peradeniya) 8: 156. 1924.

See Petrini and Petrini (1985) [as ***Hypoxylon unitum*** (Fr.: Fr.) Nitschke] and Petrini and Müller (1986) [as ***Hypoxylon serpens*** *var.* II] for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091419, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091418, wood (JDR); Nan-tou Co., Hsin-yi, Pa-tong-gwang, 7.I.1988, Ju, Y.-M., 77010707, wood (JDR); Nan-tou Co., Huei-sun, 9.X.1987, Ju, Y.-M., 76100901, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082216, wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 27.VII.1984, Ju, Y.-M., PPE-029, wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 27.VII.1984, Ju, Y.-M., PPE-028, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080713 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072332, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 28.XI.1987, Chang, C.-M., 76112802, wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052007, wood (JDR); Taipei City, Chi-shinn-shan, 15.V.1984, Ju, Y.-M., PPE-037, wood (JDR); Taipei City, Nei-hoo, 15.III.1988, Ju, Y.-M., 77031501, wood (JDR); Taipei Co., Shi-mann, 5.IV.1985, Jane, S.-T., PPE-063, wood (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062114, wood (JDR); Taipei Co., Wu-lai, 15.V.1988, Ju, Y.-M., 77051501, wood (JDR).

ADDITIONAL SPECIMENS EXAMINED: BRAZIL: Rio Grande do Sul, Hamburgerberg, 21.X.1892, Malme, corticated wood (S, HOLOTYPE of ***Hypoxylon cohaerens*** *var.* ***brasiliense***). ITALY: near Trento, III.1890, Bresadola, on corticated wood of ***Ulmus suberosa*** (BPI, TYPE of ***Hypoxylon lilacinofuscum***). MAURITIUS: Pouce, 1861, decorticated wood (K, HOLOTYPE of ***Hypoxylon irregulare***). SRI LANKA: Diyanila Kaela, 12.III.1906, Petch, T. 4923, corticated stems of tea (K, ISOTYPE of ***Hypoxylon vestitum***). U.K.: no. 373.10, wood (K, HOLOTYPE; BPI-CLS, ISOTYPE of ***Sphaeria diffusa***).

NOTES: The Taiwan material produced a ***Geniculosporium*** anamorph with conidia (4-)4.5-6 x 2.7-3.3 μm. It is much as the anamorph described by Petrini and Müller (1986) [as ***Hypoxylon serpens*** *var.* II]. This is a rather common ***Nemania*** species in Taiwan, most collections of which have ascospores 10-13 x 4-6 μm and ascal apical rings ca. 2.5 μm high x 2.5 μm broad. Specimen 77010707 differs from the other collections in having larger ascospores 13.5-15 x 5.5-6.7 μm and a longer ascal apical ring that was oblong, inverted hat-shaped, 4-5 μm high x 2.5 μm broad. Unfortunately, no cultural data are available for this large ascospore collection and it seems better to leave it in ***N. diffusa***. Those specimens identified as ***H. vogesiacum*** (Pers.) Sacc. *var.* ***microsporum*** J. H. Miller by Ju and Tzean (1985a) should be placed here.

Nemania memorabilis (Rehm) Y.-M. Ju & J. D. Rogers, *comb. nov.*
Figs. 3, 4, 31

≡ ***Nummularia memorabilis*** Rehm, Leafl. Philipp. Bot. 8: 2960. 1916.

Stromata scattered or densely aggregated, discoid or restricted-pulvinate, containing a number of perithecia, infrequently perithecioid, with abrupt margins, with flattened top and adnate base, 1-4.5 mm diam x 0.8-1.5 mm thick; surface dark brown, smooth; carbonaceous immediately beneath surface; whitish to grayish, soft between and beneath perithecia. Perithecia spherical, 0.4-0.8 mm diam. Ostioles conic-papillate, encircled by a black halo. Asci eight-spored, cylindrical, stipitate, 190-220 μm total length x 5-6 μm broad, the spore-bearing part 70-80 μm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 2-2.5 μm high x 2.5 μm broad. Ascospores brown, unicellular, ellipsoid-inequilateral, with narrowly to broadly rounded ends, 10-12(-12.5) x 4-5 μm, with straight germ slit slightly less than spore-length on flattened side.

SPECIMEN EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082227, wood (JDR).

ADDITIONAL SPECIMENS EXAMINED: PHILIPPINES: summit of Mt. Makiling, 1.VI.1914, Baker, C.F. 3432, corticated wood (S, HOLOTYPE of ***Nummularia memorabilis***). VENEZUELA: Edo Merida, Parque Nac. Sierra Nevada, elev. 2300 m, 9-17.XI.1990, Samuels, G.J. et al. 6793 (CULTURED), corticated wood (BPI; JDR).

NOTES: This fungus is characterized by discoid stromata with a flattened top and abrupt margins. Cultures from a Venezuelan specimen yielded a ***Geniculosporium*** anamorph which has hyaline (grayish in masses), obovoid to ellipsoid conidia 4-6(-7) x (1.5-)2 μm and erect, di- or trichotomously branched conidiophores 1.5-2 μm diam.

Nemania minutula (Penz. & Sacc.) Y.-M. Ju & J. D. Rogers, *comb. nov.* Fig. 5

≡ ***Nummularia minutula*** Penz. & Sacc., Malpighia 11: 495. 1897.

≡ ***Hypoxylon minutulum*** (Penz. & Sacc.) J. M. Miller *ex* S. Teng, Contr. to Our Knowledge of the Higher Fungi of China, p. 125. 1939.

See Ju and Rogers (1994) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Taipei City, Nei-hoo, 15.III.1988, Ju, Y.-M., 77031506 (CULTURED), dead culms of bamboo (JDR).

ADDITIONAL SPECIMEN EXAMINED: INDONESIA: Java, Tjibodas, 3.III.1897, no. 404, culms of ***Bambusa*** (PAD, HOLOTYPE of ***Nummularia minutula***).

NOTES: The anamorph forms dense palisades of conidiophores (Ju and Rogers, 1994). Other ***Nemania*** taxa that have been observed to produce anamorphs do not usually aggregate their conidiophores into palisades. It is our believe that the conidiophore aggregation in ***N. minutula*** is primarily due to the hard and smooth surface of bamboo culms. This phenomenon has also been observed in ***Rosellinia bambusae*** and ***R. mirabilis***. Their anamorphs are composed of densely compacted ***Geniculosporium***-like conidiophores on restricted, circular conidiomata, and were assigned to the form-genus ***Acanthodochium*** Samuels, J. D. Rogers, & Nagasawa (Ju and Rogers, 1990).

Nemania *sp.* (80082010) Fig. 32

Stromata effused-pulvinate, 1-2 cm long x 0.7-1 cm broad x 1-1.2 mm thick; surface blackened, with inconspicuous perithecial mounds; carbonaceous immediately beneath surface; scanty brown, fibrose tissue between perithecia, with carbonaceous stromatal layer discretely enclosing each perithecium; tissue beneath perithecial layer inconspicuous. Perithecia spherical, 0.5-0.7 mm diam. Ostioles papillate. Asci not seen. Ascospores light brown to brown, unicellular, ellipsoid-inequilateral, with narrowly to broadly rounded ends, 17-22 x 6-7 μm, with straight, distinct germ slit much less than spore-length on convex side.

SPECIMEN EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082010, wood (JDR).

ADDITIONAL SPECIMENS EXAMINED: SRI LANKA: Peradeniya, I.1917, Petch, T. 6103, wood (K, ISOTYPE of ***Hypoxylon angustum*** Petch). PARAGUAY: Guarapi, IX.1883, Balansa, B. 4030, corticated wood (LPS, HOLOTYPE; BPI; K, ISOTYPES of ***Hypoxylon latissimum*** Speg.). U.S.A.: Pennsylvania, Bethlehem, Syn. 1581, decorticated wood of ***Juglans***, as ***Sphaeria umbonata*** Fr. (BPI, TYPE of ***Sphaeria quadrata***).

NOTES: This fungus is peculiar among ***Nemania*** taxa in having the germ slit on the convex side of ascospore which also occurs in ***Hypoxylon angustum*** Petch, in ***H. latissimum*** Speg., and occasionally in ***H. quadratum*** (Schwein.) Ellis & Everh. ***Hypoxylon angustum*** and ***H. quadratum*** have large ascospores, 24-28 x 9-10 μm and 21-26 x (8-)9-10.5 μm, respectively, and have whitish stromatal tissue between perithecia. In addition, ***Hypoxylon quadratum*** has a very faint, broad germ slit on ascospore. ***Hypoxylon***

latissimum differs in having subicular hyphae surrounding stromata, in having coarsely papillate ostioles, and in having dark-colored ascospores.

***Nemania** sp.* (76100601) Fig. 37

Stromata scattered, subglobose to spherical, enclosing one to several perithecia, erumpent, with lower to middle part embedded in substrate, 0.5-0.6 mm diam; surface dark brown, smooth; carbonaceous immediately beneath surface and between perithecia; tissue beneath perithecial layer inconspicuous. Ostioles obtusely conical, black. Asci eight-spored, cylindrical, short-stipitate, 80-100 μm total length x 6-9 μm broad, the spore-bearing part 70-85 μm long, with apical ring bluing in Melzer's iodine reagent, cuneate, 1.5 μm high x 3 μm broad. Ascospores light brown to brown, unicellular, ellipsoid, with broadly rounded ends, 9-12 x 5-6(-6.5) μm, with straight germ slit much less than spore-length.

Colonies covering Petri dish in 2 wk, at first white, velvety, faintly zonate to azonate, with diffuse margins, then turning yellowish, becoming overlain with numerous tiny hyphal tufts evenly distributed on entire surface of colonies. Reverse uncolored. Anamorph not produced. Teleomorph produced when cultured on SMEA, with morphological features in general as described above. Most of the stromata, however, tend to be uniperitheciate.

SPECIMENS EXAMINED: Taipei Co., Tam-suei, Chu-wei, 16.XI.1988, Chang, H.-S., 77111602 (CULTURED), dead wood in mangrove forest (JDR); Taipei Co., Tam-suei, Chu-wei, 6.X.1987, Chang, C.-M., 76100601 (CULTURED), dead wood in mangrove forest (JDR).

NOTES: These two collections were made from a mangrove forest near the sea and might represent a new taxon. The stromata on natural substrates display both hypoxyloid and rosellinioid characters. It is interesting to note that this fungus did not produce an anamorph in culture whereas the teleomorph was readily produced.

RHOPALOSTROMA D. HAWKSWORTH

Rhopalostroma luzonense (C. G. Lloyd) D. Hawksworth, Kew Bull. 31: 428. 1977. Figs. 8-10

Stromata gregarious, clavate, obconical, to capitate, unbranched, 2.5-10 mm total length x 2-6 mm broad; surface purplish gray (128), fawn (87), or dark brick (60), waxy, lacking perithecial mounds, smooth; yellowish brown waxy granules immediately beneath surface, containing greenish olivaceous (90) KOH-extractable pigments or without apparent pigments; tissue between perithecial layer and granular layer forming a black crust; tissue between and beneath perithecia gray to grayish black, fibrose; tissue inside stipes black, woody. Perithecia obovate to oblong, 0.1-0.2 mm diam x 0.3-0.4 mm high. Ostioles obscure. Asci eight-spored, cylindrical, 130-150 μm total length x 4.5-5.5 μm broad, the spore-bearing part 45-55 μm long, the stipe 75-95 μm, apical ring lacking. Ascospores dark brown, unicellular, ellipsoid-inequilateral, with broadly rounded ends, 7.5-10.5 x 3.5-4 µm, with straight germ slit slightly less than to nearly spore-length on the convex side.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091111, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091110, wood (JDR).

NOTES: The Taiwan material is much as described by Hawksworth (1977) for this fungus. ***Rhopalostroma luzonense*** differs from other taxa in this genus in having ascospores less than 4 µm broad.

ROSELLINIA De Not.

Rosellinia arcuata Petch, Ann. Roy. Bot. Gard. (Peradeniya) 6: 175. 1916; *sensu* Saccas, Agron. Trop. (Nogent-sur-Marre) 11: 577. 1956.

See Saccas (1956) for a description of the teleomorph.

SPECIMEN EXAMINED: Taipei City, Young-ming-shan, 13.XII.1987, Ju, Y.-M., 76121301, wood (JDR).

NOTES: This fungus has perithecia 1.5-2.2 mm diam, and fusoid ascospores, 43-52 x 5.5-7(-8) µm, bearing a very short germ slit. Francis (1985) considered ***R. arcuata*** to be a synonym of ***R. bothrina*** (Berk. & Broome) Sacc.

Rosellinia bambusae Henn., Hedwigia 47: 256. 1908.
= ***Hypoxylon kurzianum*** Curr. *ex* Sacc., Syll. Fung. I, p. 374. 1882.

See Ju and Rogers (1990) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Yuan-shan, 1.XI.1987, Ju, Y.-M., 76110101 (CULTURED), culms of ***Dendrocalamus latiflorus*** (JDR); I-lan Co., Yuan-shan, 18.II.1984, Ju, Y.-M., 73021802, culms of ***Dendrocalamus latiflorus*** (JDR); Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091013, wood (JDR); Taipei City, Nan-kong, 23.XI.1987, Ju, Y.-M., 76112301, culms of bamboo (JDR); Taipei Co., Hsin-tien, 3.XII.1983, Ju, Y.-M., 72120301, culms of ***Dendrocalamus latiflorus*** (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062110 (CULTURED), culms of ***Phyllostachys makinoi*** (JDR).

ADDITIONAL SPECIMENS EXAMINED: PHILIPPINES: Luzon, Province of Pampanga, Mt. Aruyat, II.1906, Merrill, E.D., Bureau of Science No. 5030, dead culms of bamboo (BPI, ISOTYPE; NY, ISOTYPE of ***Rosellinia bambusae***); PEGU: Kurz, culms of bamboo (K, HOLOTYPE of ***Hypoxylon kurzianum***).

NOTES: The type material of ***Hypoxylon kurzianum*** Curr. *ex* Sacc. is strikingly similar to ***R. bambusae*** in features of stromata and in shape and size of ascospores. ***Hypoxylon kurzianum*** was not published formally until Saccardo's emendment (1882). It represents an earlier name for ***R. bambusae***. Nonetheless, the type material of ***H. kurzianum*** is in relatively poor condition compared with that of ***R. bambusae*** and has no asci. We thus prefer to use the better established ***R. bambusae*** rather than ***H. kurzianum***.

Rosellinia bunodes (Berk. & Broome) Sacc., Syll. Fung. I, p. 254. 1882.

See Saccas (1956) for a description of the teleomorph.

SPECIMEN EXAMINED: Taipei Co., Sun-shai, 9.IX.1988, Ho, S.-M., 77090902, wood (JDR).

NOTES: The material is in poor condition. It is much the same as described and illustrated by Saccas (1956). The echinate stromatal surfaces along with the long tapered ends of ascospores make this fungus easy to recognize. Cultures were not obtained from this material.

Rosellinia corticium (Schwein.: Fr.) Sacc., Syll. Fung. I, p. 253. 1882.

See Petrini (1993) and San Martín and Rogers (1995) for descriptions of the teleomorph.

Colonies covering Petri dish in 2-3 wk, at first white, velvety to felty, azonate, with diffuse margins, remaining white or turning grayish and becoming floccose. Reverse uncolored. Sporulating regions on entire surface of colony. Conidiophores erect, mostly dichotomously branched, without well-defined main axis, 3-4 μm at base, light brown, smooth. Conidiogenous cells indeterminately elongated, cylindrical, geniculate, 3-4 μm broad, hyaline to pale brown, bearing terminal and lateral poroid conidial secession scars ca. 1.2 μm diam. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid, 7.5-12(-18) x 3.5-4.5 μm, with flattened base ca. 1.5 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: I-lan Co., Yuan-shan, 18.II.1984, Ju, Y.-M., 73021801, wood (JDR); Nan-tou Co., Huei-sun, 1.IV.1985, Ju, Y.-M., 74040401, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082223 (CULTURED), wood (JDR); Taipei City, Campus of National Taiwan Univ., 9.VI.1988, Ju, Y.-M., 77060901 (CULTURED), twig of ***Cinnamomum camphora*** (JDR); Taipei Co., Shi-mann, 5.IV.1985, Jane, S.-T., 74040501, twig of ***Acacia confusa*** (JDR); Taipei Co., Wu-lai, 26.II.1980, collector unknown, 69022601, wood (JDR).

NOTES: ***Rosellinia corticium*** is close to ***R. aquila*** (Fr.: Fr.) De Not. and differs from the latter mainly on its larger ascospores. Shear (1941) discussed this in detail. ***Rosellinia corticium*** usually bears a tiny cellular appendage on one end of an ascospore, infrequently a cellular appendage on each end of an ascospore, surrounded by a clear hyaline sheath. Typical ***R. aquila*** generally has one cellular appendage on each end of an ascospore which is surrounded by a hyaline sheath. However, the number of appendages per ascospore should by used cautiously for taxonomic purposes, since some specimens from North America have ascospores similar in size to typical ***R. aquila*** but generally only one cellular appendage on each ascospore. Moreover, the conidiogenous structures of these fungi seem essentially identical. The conidia produced by the present fungus in culture are slightly larger than those of ***R. aquila*** given by Greenhalgh and Chesters (1968) and Petrini (1993), i.e., 7.5-12(-18) x 3.5-4.5 μm vs. 3.5-11.5 x 1.5-4.5 μm vs. 5.5-11.5 x 4-5 μm. However, the conidia of the present fungus produced in nature are 5-8 x 2.5-4 μm. The size ranges of conidia which are produced by a single taxon on different substrates seem variable. In any case, until more data are available, the name ***R. corticium*** is used here only in recognizing those specimens in the ***R. aquila*** complex with larger ascospores than typical ***R. aquila***. Also compare with ***R. merrillii*** Syd. & P. Syd. elsewhere herein.

Rosellinia formosana Y.-M. Ju & J. D. Rogers, *sp. nov.* Figs. 11, 12, 45

Etymology: After Taiwan

A Rosellinia megalospora differt in ascosporis vaginis hyalinis, (71-)78-98 x 8.5-11.3 μm, et in rima germinativa recta longa.

Stromata perithecioid, scattered, superficial, subglobose, with broadly truncate base, 0.8-1.3 mm diam x 0.6-0.9 mm high, externally and internally blackish, produced at the center of a black thin restricted hyphal mat closely adhering to substrate surface; texture carbonaceous; surface smooth, polished. Ostioles conical. Asci four- to eight-spored, the spores often biseriate, clavate-cylindrical, short-stipitate, 190-270 μm total length x 16-23 μm broad, the spore bearing part 175-260 μm long, with apical ring bluing in Melzer's iodine reagent, urn-shaped, 8-10 μm high x 8.5 μm broad. Ascospores brown, unicellular, oblong fusoid-inequilateral, with narrowly rounded ends, enclosed by a hyaline sheath, (71-)78-98 x 8.5-11.3 μm, with straight germ slit spore-length on flattened side.

SPECIMEN EXAMINED: Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062102, stems of ***Miscanthus floridulus*** (WSP, HOLOTYPE of ***Rosellinia formosana***).

NOTES: This large-spored ***Rosellinia*** differs from ***R. megalospora*** Saccas as described by Saccas (1956) in having a hyaline sheath surrounding each ascospore and a spore-length germ slit. In addition, the former lacks a conspicuous subiculum but, instead, forms a black thin restricted hyphal mat closely adhering to the substrate surface. The hyphal mat is reminiscent of the conidiomata found in ***R. bambusae*** and ***R. sublimbata***. Attempts to obtain cultures from this fungus failed.

Rosellinia griseocincta Starb., Bih. Kongl. Svenska Vetensk.-Akad. Handl. 25, 3: 49. 1899. Figs. 34, 49

Stromata perithecioid, gregarious, solitary to several coalescent, superficial or nearly so, spherical, 0.6-0.8 mm diam, dark brown to black externally and internally, with whitened surrounding substrate apparently caused by evanescent subiculum; texture carbonaceous; surface smooth. Perithecia spherical, 0.5-0.7 mm diam. Ostioles conic-papillate. Asci eight-spored, cylindrical, short-stipitate, 95-110 μm total length x 7-8 μm broad, the spore-bearing part 80-85 μm long, with apical ring bluing in Melzer's iodine reagent, discoid, 2-2.5 μm high x 3.5 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 13.5-15.5 x 6-7.5 μm, with straight germ slit spore-length or nearly so on flattened side.

Colonies covering Petri dish in 6-7 wk, white, velvety, densely zonate, with entire to lobed margins and furrows radiating from center. Reverse grayish brown. Sporulating regions over surface of colonies after transferring entire culture onto SMEA plate. Conidiophores erect, di- or trichotomously branched several times from base, without well-defined main axis, 2.5-3 μm broad at base, olivaceous, smooth. Conidiogenous cells indeterminately elongated, cylindrical, geniculate, 2-3 μm broad, hyaline, smooth, bearing terminal and lateral poroid conidial secession scars ca. 0.5 μm diam. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth to slightly wrinkled, subglobose to obovate, 3-4 x 2-2.5(-3) μm, with flattened base ca. 0.7 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082246, decorticated wood (JDR); Ping-tung Co., Heng-chun, Kenting, 23.VIII.1988, Ju, Y.-M., 77082325 (CULTURED), wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052017, decorticated wood (JDR).

ADDITIONAL SPECIMENS EXAMINED: BRAZIL: Rio Grande do Sul, Santo Angelo, 16.I.1893, Malme 128, decorticated wood (S, HOLOTYPE of ***Rosellinia griseocincta***). U.S.A.: Louisiana, St. Martinsville, 11.II.1889, Langlois, A.B., Flora Ludoviciana 1768, decaying wood of an old live oak stump (NY, HOLOTYPE of ***Rosellinia glandiformis*** Ellis & Everh.).

NOTES: The anamorph of ***R. griseocincta***, which is assignable to ***Geniculosporium***, resembles that of ***R. subiculata*** (Rogers, 1985; Petrini, 1993; San Martín and Rogers, 1995). These two fungi differ in that ***R. griseocincta*** has larger ascospores and lacks a yellow subiculum. The white subiculum usually disappears fairly early and leaves a whitened area surrounding each stroma. ***Rosellinia glandiformis*** Ellis & Everh. and ***R. griseocincta*** have the same stromatal features but the former has larger ascospores, 16.5-19 x 8-9 μm. Petrini (1993) intended to exclude ***R. glandiformis*** from ***Rosellinia***. She suggested a placement in ***Hypoxylon*** section ***Primocinerea*** or close to ***Anthostomella***. Recently, we obtained the teleomorph of ***R. griseocincta*** in culture from a Puerto Rican collection [St. John, Reef Bay Trail, 2.I.1995, Lodge, D.J. & Henderson, W.J. St. J.-201.2, decorticated wood (JDR)]. The stromata are perithecioid as those collected from natural substrates. It is noteworthy that ***R. griseocincta***, ***R. glandiformis***, and ***R. subiculata*** normally grow on rotten wood.

Rosellinia lamprostoma Syd. & P. Syd., Philipp. J. Sci. 8: 273. 1913.
Figs. 13, 35

Stromata perithecioid, gregarious, solitary to several coalescent, superficial, ovate, 0.7-1 mm diam x 1-1.2 mm high; black externally and internally, without apparent subiculum; texture carbonaceous; surface smooth. Perithecia ovate, 0.5-0.7 mm diam x 0.8-1 mm high. Ostioles dome-shaped. Asci eight-spored, cylindrical, short-stipitate, 200-245 μm total length x 16-20 μm broad, the spore-bearing part 180-225 μm long, with apical ring bluing in Melzer's iodine reagent, coffin-shaped, 12-15 μm high x 6.5-7 μm broad. Ascospores light brown, unicellular, fusoid-inequilateral, with nearly acute ends, 38-65 x 9-12 μm, with straight germ slit spore-length frequently on convex side.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091007, twigs (JDR).

ADDITIONAL SPECIMENS EXAMINED: PHILIPPINES: Los Baños, X.1913, Baker, C.F. 1796, decorticated twigs of ***Claoxylon elongatum***, as ***Rosellinia lamprostoma*** by Rehm, H. (S); Los Baños, 16.III.1914, Raimundo, M.B. 2975, twigs of ***Streblus asper***, as ***Rosellinia megalosperma*** Syd. & P. Syd. by Rehm, H. (S).

NOTES: The type was originally described by Sydow and Sydow (1913) from Luzon, Philippines. Our fungus fits the protologue very well. Unfortunately, we were unable to locate the type but a specimen, Baker 1796, identified by Rehm (1916) as ***R. lamprostoma*** at S was examined. Rehm's fungus is the same as ours. This fungus is characterized by the dome-shaped ostiole and long, fusoid ascospores.

Rosellinia merrillii Syd. & P. Syd., Philipp. J. Sci. 8: 485. 1913.
Figs. 36, 50

≡ ***Hypoxylon acuminosporum*** P. Martin, J. S. African Bot. 42: 71. 1976.

Stromata perithecioid, densely aggregated, spherical, 1.2-1.5 mm diam, superficial, with lower part embedded in purplish brown subiculum, externally dark brown, internally blackish; texture carbonaceous, fragile; surface smooth. Perithecia spherical, 0.9-1.2 mm diam, shrinking and becoming bowl-shaped when dry. Ostioles conic-papillate to conical, black, usually with a central umbilicate perforation. Asci eight-spored, with spores arranged in a uniseriate or partially biseriate manner, cylindrical, short-stipitate, 210-250 μm total length x 12.5-18 μm broad, the spore-bearing part 175-190 μm long, with apical ring bluing in Melzer's iodine reagent, urn-shaped, 12-15 μm high x 7.5-8.5 μm broad. Ascospores dark brown to blackish brown, unicellular, surrounded by a hyaline sheath enlarged at both ends, ellipsoid-inequilateral, with narrowly or broadly rounded to abruptly pinched ends, (29-)31.5-35(-38) x 10-12 μm, with straight germ slit slightly less than spore-length on convex side.

Colonies covering Petri dish in 1 wk, at first white, velvety, azonate, with diffuse fimbriate margins, then turning dark gray to blackish, overlain with whitish, felty hyphal layer. Reverse uncolored. Conidium-bearing structures produced on surfaces of colonies, especially at periphery. Conidiophores erect, mostly dichotomously branched, without well-defined main axis, 3-4.5 μm at base, light brown, smooth. Conidiogenous cells indeterminately elongated, cylindrical, geniculate, 3-4 μm broad, hyaline to pale brown, bearing terminal and lateral poroid conidial secession scars ca. 1.2 μm diam. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid, 5.5-8(-10) x 3.5-4.5(-5) μm, with flattened base ca. 1.5 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091120, wood (JDR); Ping-tung Co., Heng-chun, Kong-ko, 24.VIII.1988, Ju, Y.-M., 77082401 (CULTURED), twig (JDR).

ADDITIONAL SPECIMEN EXAMINED: PHILIPPINES: Luzon, Mt. Makiling, III.1913, Merrill, E.D. 8660, decorticated wood (S, HOLOTYPE of ***Rosellinia merrillii***).

NOTES: This taxon has larger ascospores than ***R. corticium***. In addition, no cellular appendages were found on either young or mature ascospores. The anamorph of ***R. merrillii*** has shorter conidia than that of ***R. corticium***, but they seem otherwise identical. However, as mentioned earlier in discussing ***R. corticium*** herein, conidial size differences of these members in the ***R. aquila*** complex must be interpreted cautiously.

Rosellinia mirabilis (Berk. & Broome) Y.-M. Ju & J. D. Rogers, Mycologia 82: 343. 1990.

See Ju and Rogers (1990) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Yuan-shan, 1.XI.1987, Ju, Y.-M., 76110110 (CULTURED), culms of ***Dendrocalamus latiflorus*** (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082238 (CULTURED), culms of ***Phyllostachys pubescens var. pubescens*** (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082204, culms of ***Phyllostachys pubescens var. pubescens*** (JDR).

ADDITIONAL SPECIMEN EXAMINED: SRI LANKA: Twaite, L.H.K. 785, dead culms of bamboo (K, HOLOTYPE of ***Astrocystis mirabilis***).

NOTES: Petrini (1993) and Laessøe and Spooner (1994) retained this fungus in ***Astrocystis*** Berk. & Broome which was considered to be a synonym of ***Rosellinia*** by Ju and Rogers (1990).

Rosellinia necatrix (R. Hartig) Berl., Rev. Patol. Veg. 1: 5. 1892. Fig. 51

The teleomorph is as described by Saccas (1956), Rogers et al. (1987), Petrini (1993), and San Martín and Rogers (1995) except that the Taiwan specimen has smaller ascospores 28-37 x 5.5-6.5(-7) μm.

SPECIMEN EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082249, wood (JDR).

NOTES: The synnematal anamorph, closely associated with the teleomorph on the natural substrate, is identical to the description and illustration in Saccas (1956). According to Francis (1985) and Petrini (1993), the nomenclatural status of ***R. necatrix*** is unsettled.

Rosellinia procera Syd. & P. Syd., Ann. Mycol. 8: 37. 1910.
= ***Rosellinia megalosperma*** Syd. & P. Syd., Philipp. J. Sci. 8: 485. 1913.

See San Martín and Rogers (1995) for a description of the teleomorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 8.III.1985, Ju, Y.-M., 74030801, twigs (JDR); Nan-tou Co., Huei-sun, 9.X.1987, Ju, Y.-M., 76100902, wood (JDR); Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091017, wood (JDR); Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091012, wood (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062115, wood (JDR).

ADDITIONAL MATERIAL EXAMINED: PHILIPPINES: Luzon, Manila and vicinity, I.1913, Merrill, E.D. 8510, dead twigs of ***Streblus asper*** (S, HOLOTYPE of ***Rosellinia megalosperma***); Los Baños, 10.XI.1913, Baker, C.F. 2001, dead ***Alchornea rugosa***, as ***Rosellinia procera*** by Rehm, H. (S).

NOTES: This fungus is apparently close to taxa in the ***R. aquila*** complex, but with extremely large ascospores. Unfortunately, attempts to obtain culture failed. San Martín and Rogers (1995) suspected ***R. megalosperma*** Syd. & P. Syd. to be a later synonym of ***R. procera***. Our observation on the type of the former confirmed their opinion.

Rosellinia sublimbata (Durieu & Mont.) Pass. *apud* Thüm., Inst. Revista Sci. Litt. Coimbra, ser. II, 27: 33. 1879.

See Petrini (1993) and Ju and Rogers (1994) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Kao-hsiung Co., Tien-chee, 28.I.1988, Sivanesan, A. et al., 77012801, culms of ***Yushania nutakayamensis*** (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082229 (CULTURED), culms of bamboo (JDR); Taipei City, Young-ming-shan, 13.XII.1987, Ju, Y.-M., 76121302, culms of bamboo (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062111, culms of bamboo (JDR).

ADDITIONAL SPECIMEN EXAMINED: ALGERIA: Durieu, M. no. 36, culms of ***Arundo mauritanica*** (K, TYPE of ***Sphaeria sublimbata***).

NOTES: ***Rosellinia sublimbata***, ***R. mirabilis***, and ***R. bambusae*** are similar in inhabiting bamboo culms and in having the outermost stromatal layer encircling the lower part of individual stromata. These taxa can readily be differentiated by ascospore size ranges and anamorphs.

STILBOHYPOXYLON HENN.

Stilbohypoxylon quisquiliarum (Mont.) J. D. Rogers & Y.-M. Ju, Mycol. Res. 101: 137. 1997.

≡ ***Hypoxylon quisquiliarum*** (Mont.) Mont., Ann. Sci. Nat. Bot., sér. IV, 3: 117. 1855.

= ***Hypoxylon rosellinioides*** Henn., Bot. Jahrb. Syst. 38: 115. 1905.

See Miller (1961) for a description of the teleomorph. See Rogers and Ju (1997) for descriptions of the colonies and anamorph.

SPECIMENS EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082222 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-047, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091122, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082335, wood (JDR); Taipei City, Chi-shinn-shan, 15.V.1984, Ju, Y.-M., PPE-017, wood (JDR).

ADDITIONAL SPECIMENS EXAMINED: FRENCH GUIANA: Cayenne, Leprieur, C. 366, wood (FH [Patouillard Herb., sheet 7462], ISOTYPE of ***Sphaeria quisquiliara***). TANZANIA: Amani, Ost-Usambara, X.1903, Eichelbaum, F., corticated wood (S, LECTOTYPE [selected by Ju and Rogers (1996)] of ***Hypoxylon rosellinioides***).

NOTES: The short clavate synnemata and the vivid yellow colonies are striking features of this fungus. See NOTES on ***Halorosellinia oceanica*** herein for comparison between ***S. quisquiliarum*** and ***H. oceanica***. Ju and Tzean (1985a) [as ***Hypoxylon quisquiliarum*** Mont.] have recorded this fungus in Taiwan.

Stilbohypoxylon *sp.* (77062107) Figs. 39, 53

Stromata perithecioid, gregarious, spherical to subglobose, 0.5-0.8 mm diam, infrequently ornamented with a short appendage on top, black externally and internally, underlain with appressed, black mycelial layer closely adhering to substrate; surface smooth; texture leathery. Ostioles papillate. Asci eight-spored, cylindrical to clavate-cylindrical, 120-130 μm total length x 8-9 μm broad, the spore-bearing part 80-90 μm long, with apical ring bluing in Melzer's iodine reagent, cuneiform, 1.5-2 μm high x 2.5-3 μm broad. Ascospores brown to dark brown, unicellular, fusoid, with narrowly rounded ends, 12-16 x 5-6(-6.5) μm, with slightly oblique germ slit spore-length.

Colonies covering Petri dish in 2 wk, at first whitish, velvety, appressed, azonate, with entire margins, becoming overlain with black mycelial layer. Reverse uncolored. Synnemata scattered mainly at periphery of colony, short cylindrical to acicular, blackish, up to 1 mm high x 0.1 mm broad at base. Teleomorph produced after entire colony transferred to SMEA, with morphological features as described above. Sporulating regions on upper surfaces of synnemata. Conidiophores upright in palisades, di- or trichotomously branched several times from base, smooth, olivaceous brown. Conidiogenous cells terminal, obclavate to cylindrical, 7-12 x 2.5-3.5 μm, smooth-walled, bearing denticulate conidial secession scars, 0.5 μm high x 0.5 μm broad at base. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (white in masses), smooth, obovate to ellipsoid, (4-)4.5-5.5 x 1.5-2.5 μm, with flattened base 0.5-1 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062107 (CULTURED), fronds of ***Arenga engleri*** (JDR).

ADDITIONAL SEPCIMENS EXAMINED: NEW ZEALAND: Auckland, vic. Kawakawa Bay, Te Morehu Scenic Reserve, 4.XII.1980, Samuels, G. J. et al. 80-181, ***Cyathea medullaris*** (PDD 49707); Auckland, Te Morehu Scenic Reserve, between Kawakawa Bay & Orere Pt., 25.VI.1980, Samuels, G. J. et al. 80-77, ***Cyathea medullaris*** (PDD 49657); Auckland, Waitakere Ra., Huia, 26.III.1981, Samuels, G. J. et al. 81-38, ***Cyathea medullaris*** (PDD 49615). VENEZUELA: Edo Aragua, Parque Nacional Henri Pittier, vic. Rancho Grande Biological Station, trail between El Portachuelo and Pico Periquito, elev. 1200-1400 m, 2.XII.1990, Samuels, G. J. et al. 7788, decaying palm frond (BPI).

NOTES: Occasionally, a short spike, probably representing the synnematal remnant, can be found on some stromata in nature. In culture, it can be clearly observed that the teleomorph originates either from the base of a synnema or from a site that is not associated with synnemata. When the teleomorph is produced at the base of a synnema, the white conidial masses which were previously produced on the top of synnemata usually remain around the ostioles. We suspect that this fungus has previously been described as a ***Rosellinia*** species. Therefore, we hesitate to give it a new name until a more thorough name search in ***Rosellinia*** is accomplished.

Stilbohypoxylon sp. (75021102) Fig. 38

Stromata perithecioid, scattered, spherical, 0.6-0.8 mm, dark brown externally and internally, with small amount of white tissue beneath perithecium, with acicular appendage frequently found on young stromata but infrequently on mature ones; texture leathery; surface smooth. Ostioles slightly papillate, black. Asci eight-spored, cylindrical, stipitate, 160-195 μm total length x 9-12 μm broad, the spore-bearing part 120-140 μm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 4.5-5 μm high x 4 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, enclosed within thin, hyaline sheath which swells to form 1-1.5 μm long noncellular appendage at each end, 18-21.5 x (7-)8-9 μm, with straight germ slit slightly less than spore-length on flattened side.

SPECIMEN EXAMINED: Chia-yi Co., Wu-fong, A-lee-shan, 11.II.1986, Ju, Y.-M., 75021102, twigs (JDR).

NOTES: This fungus might have been described as a ***Rosellinia*** species. Different developmental stages of stromata were found in this collection, ranging from incipient stromata bearing a spike of probable synnematal origin to fully mature stromata. Most of the mature stromata do not bear the spike. Subiculum was not found in any of the developmental stages. The ascospore morphology is reminiscent of those in ***R. mammaeformis*** (Pers.: Fr.) Ces. & De Not. and its related species (Petrini and Petrini, 1989). In any case, we decline to name it until more information is available for this fungus and ***Rosellinia*** in general.

WHALLEYA J. D. Rogers, Y.-M. Ju, & San Martín

Whalleya microplaca (Berk. & M. A. Curtis) J. D. Rogers, Y.-M. Ju, & San Martín, Mycotaxon 64: 48. 1997.
≡ ***Hypoxylon microplacum*** (Berk. & M. A. Curtis) J. H. Miller, Mycologia 33: 77. 1941.

See Miller (1961) for a description of the teleomorph. See Jong and Rogers (1972) for a description of the anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 27.VI.1984, Ju, Y.-M., PPE-013, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 7.II.1984, Ju, Y.-M., PPE-006, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 11.X.1996, Ju, Y.-M., 85101107, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091423 (CULTURED), wood (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 27.VII.1984, Ju, Y.-M., PPE-044, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080715 (CULTURED), wood (JDR); Tai-tung Co., Lan-yuh, Ta-sun-shan, 20.V.1988, Hsieh, H.-M., 77052010, wood (JDR); Taipei City, Chi-shinn-shan, 15.V.1984, Ju, Y.-M., PPE-022, wood (JDR); Taipei City, Nei-hoo, 15.III.1988, Ju, Y.-M., 77031507, wood (JDR); Taipei City, Ta-tung-shan, IV.1985, Ju, Y.-M., PPE-057, wood (JDR); Taipei City, Young-ming-shan, 14.VII.1988, Ju, Y.-M., 77071409, wood (JDR); Taipei City, Young-ming-shan, 8.I.1988, Chang, C.-

M., 77010803, wood (JDR); Taipei Co., Shaukotou, III.1984, Jane, S.-T., PPE-009, wood (JDR); Taipei Co., Shi-mann, 5.IV.1985, Jane, S.-T., PPE-061, wood (JDR).

NOTES: This fungus is one of the few xylariaceous fungi known to produce scolecosporous conidia. Additional taxa are those reported by Ju et al. (1993) and Rogers et al. (1997). Ju and Tzean (1985a) [as ***Hypoxylon microplacum*** (Berk. & M. A. Curtis) J. H. Miller] have reported this fungus in Taiwan.

XYLARIA HILL *EX* SCHRANK

Xylaria allantoidea (Berk.) Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 127. 1851. Fig. 54

See Rogers (1984), Ju and Tzean (1985b), and San Martín and Rogers (1989) for descriptions of the teleomorph.

There are two differently colored, but otherwise identical, stromatal types among our collections. One type is dark purplish brown and the other is copper brown. Each yields a morphologically distinct colony. Cultures are correlated with stromatal color in color of conidial masses, in colony color, and in growth rates. They are described below.

Cultures from stromata with a dark purplish brown surface.

Colonies covering Petri dish in 2.5 wk, at first pale pinkish, velvety to felty, zonate, with plumose margins, developing blackish patches on surface of agar from center outwards. Reverse uncolored to brownish. Stromata scattered, aculeate to digitate, 2-4 mm diam at base, ochraceous orange at first, then becoming mouse gray as conidiogenous layer developed. Sporulating regions on entire surfaces of stromata. Conidiophores in upright palisades, di- or trichotomously branched several times from base, hyaline to pale brown, smooth. Conidiogenous cells terminal, cylindrical, 10-20 x 2.5-3 μm, hyaline, smooth to finely warted, bearing lateral and terminal denticulate conidial secession scars, ca. 0.5 μm high x 0.5 μm broad at base. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (gray in masses), finely roughened, ellipsoid to obovate, 5-7 x 3-4 μm, with small flattened base ca. 0.8 μm broad indicating former point of attachment to conidiogenous cell. Some conidia with flattened apices or small, corona-like apical processes. Conidia germinating in culture.

SPECIMENS EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 22.X.1996, Chou, W.-N., 87102201, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082027, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082026, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080707 (CULTURED), wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080704-1 (CULTURED), wood (JDR); Nan-tou Co., Yu-chee, Sun-moon Lake, 25.X.1988, Chou, W.-N., 77102501 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091119, wood (JDR).

Cultures from stromata with a copper brown surface.

Colonies never covering Petri dish, at first whitish, velvety, appressed, with entire or irregular margins, then darkening from center outwards. Reverse brownish. Stromata scattered, mostly located at centers of colonies, digitate, 5-7 mm diam at base, ochraceous at first, then becoming golden yellow as conidiogenous layer developed. Sporulating regions on entire surfaces of stromata. Conidiophores in upright palisades, di- or trichotomously branched several times from base, pale yellow, smooth to finely warted. Conidiogenous cells terminal, cylindrical, 15-25 x 2.5-3 μm, hyaline, warted, bearing lateral and terminal denticulate conidial secession scars, ca. 0.5 μm high x 0.5 μm broad at base. Conidia produced holoblastically in sympodial sequence. Conidia pale yellow (golden yellow in masses), finely roughened, ellipsoid to obovate, 5.5-7 x 3-4 μm, with small flattened base ca. 0.8 μm indicating former point of attachment to conidiogenous cell. Some conidia with flattened apices or small, corona-like apical processes. Conidia germinating in culture.

SPECIMEN EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080704 (CULTURED), wood (JDR).

NOTES: Although both types of colony morphology are strikingly different macroscopically, their microscopic features are almost identical. They probably represent two color variants of the same taxon. Callan and Rogers (1990) described a fungus from French Guiana, tentatively identified as ***X. cf. allantoidea***, with conidia 7-11 x 4-4.5 μm, slightly larger than those of the Taiwan material. That fungus had conidiophore and conidial characteristics very much as described here. This indicates that they are closely allied or conspecific. The recent descriptions of cultures and anamorph in Van der Gucht (1996) appear to correspond to those given herein from the stromata with a dark purplish brown surface. Also compare with ***X. papyrifera*** herein.

Xylaria anisopleura (Mont.) Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 127. 1851.

See Ju and Tzean (1985b), Rogers et al. (1987), and San Martín and Rogers (1989) for descriptions of the teleomorph.

Colonies and stromata are as described by Rogers et al. (1988). Sporulating regions on the upper surfaces of stromata. Conidiophores in upright palisades, dichotomously branched several times from base, olivaceous brown, smooth. Conidiogenous cells terminal, cylindrical, (10-)30-70 x 3-4 μm, hyaline to pale brown, smooth, bearing lateral and terminal discoid conidial secession scars ca. 0.5 μm high x 0.8 μm diam. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (olivaceous in masses), smooth, ellipsoid to obovate, 8-9.5 x 2.5-3.2(-4) μm, with flattened base 0.8-1 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 27.VII.1986, Ju, Y.-M., PPE-181, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 5.IX.1987, Ju, Y.-M., 76090503 (CULTURED), wood (JDR); Kao-hsiung Co., Tien-chee, 28.I.1988, Chang, H.-S., 77012802 (CULTURED), wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080701 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-084, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082310 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Kenting, 23.VII.1987, Ju, Y.-M., 76072329 (CULTURED), wood (JDR); Tai-tung Co., Chen-kung, Hsio-kong, I.1986, Ju, Y.-M., PPE-186, wood (JDR); Taitung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052001 (CULTURED), wood (JDR); Taipei City, Campus of National Taiwan Univ., 23.IX.1984, Ju, Y.-M., PPE-074, wood (JDR); Taipei City, Hsipei, 6.XI.1983, Ju, Y.-M., PPE-066, wood (JDR); Taipei City, Ta-tung-shan, IV.1985, Ju, Y.-M., PPE-091, wood (JDR); Taipei City, Young-ming-shan, 14.VII.1988, Ju, Y.-M., 77071402 (CULTURED), wood (JDR); Taipei Co., Wu-lai, 11.VII.1985, Ju, Y.-M., PPE-101, wood (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062104 (CULTURED), wood (JDR).

NOTES: The specimens listed above comprise a series of stromatal variations, from sessile and solitary with rounded fertile tops to long-stipitate and caespitose with pointed sterile tops. All of these morphs show the more or less conspicuous perithecial contours and have ascospores (21-)22-27(-30) x 7-9(-9.5) µm.

Xylaria apiculata Cooke, Grevillea 8: 66. 1879.

See Rogers and Samuels (1986) for a description of the teleomorph.

SPECIMENS EXAMINED: Chia-yi Co., Wu-fong, A-lee-shan, 11.II.1986, Ju, Y.-M., 75021101, wood (JDR); I-lan Co., Ta-yuan-shan, 15.V.1986, Ju, Y.-M., PPE-118, wood (JDR).

NOTES: This taxon represented by the Taiwan specimens has the ascospore size range 21-24.5(-26.5) x 7-9.5 µm. Ju and Tzean (1985b), while dealing with the Taiwan ***Xylaria***, applied the Dennis' (1956) concept of ***X. apiculata*** to a small penzigioid fungus which fits the description of ***X. schreuderiana*** van der Bijl in Rogers and Samuels (1986). Also see the NOTES on ***X. schreuderiana*** herein.

Xylaria apoda (Berk. & Broome) J. D. Rogers & Y.-M. Ju, Mycotaxon 68: 369. 1998.

See Rogers and Ju (1998) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091413, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072305 (CULTURED), wood (JDR).

Xylaria arbuscula Sacc., Michelia 1: 249. 1878.

See Ju and Tzean (1985b), Rogers et al. (1988), and San Martín and Rogers (1989) for descriptions of the teleomorph. See Callan and Rogers (1990) for a description of the anamorph.

Teleomorph induced in culture by transferring stromata produced on OA to SMEA, with morphological features as described for the teleomorph collected in field.

SPECIMENS EXAMINED: Chia-yi Co., Wu-fong, A-lee-shan, 24.VII.1988, Hsieh, H.-M., 77072403, dead stem of ***Eupatorium formosanum*** (JDR); Hwa-lien Co., Chih-nan, 8.III.1985, Ju, Y.-M., PPE-088, wood (JDR); Hwa-lien Co., Ho-zien, 20.VII.1986, Ju, Y.-M., PPE-120, wood (JDR); Hwa-lien Co., Ho-zien, 20.VII.1986, Ju, Y.-M., PPE-119, wood (JDR); Hwa-lien Co., Tai-lu-ko, 9.III.1985, Ju, Y.-M., PPE-089, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091410, wood (JDR); I-lan Co., Yuan-shan, 1.XI.1987, Ju, Y.-M., 76110107 (CULTURED), dead palms (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080706 (CULTURED), wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082030, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082332, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072312, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072321, wood (JDR); Tai-chung Co., Hsin-sei, 27.X.1987, Kuo, K.-J., 76102702 (CULTURED), dead vines of ***Vitis vinifera*** (JDR); Tai-tung City, Lee-yu-shan, 21.V.1988, Hsieh, H.-M., 77052101 (CULTURED), dead wood of ***Leucaena glauca*** (JDR); Tainan Co.,Yu-ging, IX.1984, Fang, J.-G., PPE-086, wood (JDR); Taipei City, Campus of National Taiwan Univ., 9.VI.1988, Ju, Y.-M., 77060902 (CULTURED), twigs of ***Cinnamomum camphora*** (JDR); Taipei City, Campus of National Taiwan Univ., 8.XI.1987, Ju, Y.-M., 76110802 (CULTURED), dead palms (JDR); Taipei City, Young-ming-shan, 14.VII.1988, Ju, Y.-M., 77071403 (CULTURED), wood (JDR); Taipei Co., Shi-mann, 5.IV.1985, Jane, S.-T., PPE-090, wood (JDR); Taipei Co., Tam-suei, Chu-wei, 21.VII.1988, Ju, Y.-M., 77072101 (CULTURED), dead palms (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062112, wood (JDR).

NOTES: This common ***Xylaria*** has been found to inhabit both monocot and dicot substrates. It has ascospores (12-)12.5 -15.5 x 4.5-5.5(-6) μm and conidia 4.5-7 x 1.5-2 μm. It represents the central member of the ***X. arbuscula*** complex which includes numerous described taxa that usually possess a striped, gray to tan peeling layer on the stromatal surface and acute sterile stromatal apices. We were able to induce the teleomorph in culture for most isolates of this fungus.

The following collections appear to fit the description of ***X. brachiata*** Sacc. in San Martín and Rogers (1989): Nan-tou Co., Hsin-yi, 13.VIII.1988, Kuo, K.-J., 77081301 (CULTURED), dead vines of ***Vitis vinifera*** (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082009, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072310 (CULTURED), twigs (JDR); Tao-yuan Co., Fu-hsin, La-la-shan, 15.XI.1986, Ju, Y.-M., 75111503, wood (JDR). They are much as ***X. arbuscula*** but differ from the latter in having slightly smaller ascospores, 11-13.5 x 4.5-5.5 μm, and in having a nearly spore-length ascospore germ slit. This morph has also been collected from sugarcane from Taiwan [Tainan Co., 1986, Fang, J.-G. (JDR)] and U.S.A. [Louisiana, Houma, X.1938, Ronds, R.D., as ***X. multiplex*** by Miller, J.H. (BPI)].

Hsieh (1980) and Fang et al. (1986) reported a slender ***Xylaria*** causing a root and basal stem rot of sugarcane in Taiwan. We have examined a specimen received from Fang [Tainan Co., Yu-ging, IX.1984, Fang, J.-G., 73090001, root and basal stem of ***Saccharum officinarum*** (JDR)]. It is undoubtedly a member of the ***X. arbuscula*** complex. It differs from ***X. arbuscula*** in having thinner stromata, 1-1.5 mm diam, in having conspicuous perithecial contours, and in having smaller ascospores, (9-)10-11.5(-12.5) x 4-5 µm, with broader ends. A culture of this fungus sent by W. H. Hsieh has anamorphic and colony features much as those of ***X. arbuscula*** except for having a slow colony growth rate. Unlike colonies of ***X. arbuscula*** which cover 9 cm Petri dishes in 3 weeks, colonies of this sugarcane ***Xylaria*** never reach the edges of Petri dishes. This fungus may represent a new taxon. Fang et al. (1986) mentioned that it resembles ***X. warburgii*** Henn. which has been collected only from fallen capsules of ***Sloanea*** species (Dennis, 1974).

Ju 77080705 [Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080705 (CULTURED), twigs (JDR)] is another member of the ***X. arbuscula*** complex that has smaller ascospores, 9.5-11(-12) x 4-5 µm, than ***X. arbuscula***. It produced the teleomorph in culture which had an ascospore size range identical to the teleomorph collected from field. Cultures and anamorph are, however, much as in ***X. arbuscula***. This collection differs from that sugarcane ***Xylaria*** in having ascospores with narrowly rounded ends, in having a nearly spore-length germ slit on the ascospore, and in lacking conspicuous perithecial contours. Rehm (1914a) described ***X. bacillaris*** from Luzon, Philippines which the Taiwan collection seems to match. He gave the ascospore size 10-11 x 4 µm. ***Xylaria bacillaris*** was considered by Dennis (1958) to be a synonym of ***X. mellisii*** (Berk.) Cooke. The latter is considered by him to be an earlier name of ***X. arbuscula***. Unfortunately, we were unable to locate the type of ***X. bacillaris*** at S.

Xylaria arbuscula Sacc. *var.* ***plenofissura*** Y.-M Ju & S.-S. Tzean, Trans. Mycol. Soc. R.O.C. 1: 107. 1985.

See Ju and Tzean (1985b) for a description of the teleomorph.

Colonies covering Petri dish in 3-4 wk, at first white, velvety, appressed, zonate, with entire margins; then turning blackish on surfaces. Reverse uncolored or brownish. Stromata arranged in two to three concentric rings, cylindrical, 1.5-2.5 mm diam at base, unbranched or branched once to several times at point of contact with lid of Petri dish, initially whitish, immediately becoming blackish from base upwards. Teleomorph induced in culture by transferring stromata produced on OA to SMEA, with morphological features as described for the teleomorph collected in field. Sporulating regions on ostioles of young perithecia in pustules. Conidiophores in upright loose palisades, di- or trichotomously branched several times from base, brownish, smooth. Conidiogenous cells terminal, cylindrical, 6-13 x 2-3 µm, hyaline, smooth, bearing terminal denticulate conidial secession scars ca. 0.5 µm high x 0.5 µm broad at base. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (white collectively), smooth, oblong ellipsoid, usually asymmetrical with a faint apical beak, 5.5-7 x 1.5-2 µm, with flattened base ca. 0.7 µm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-081, wood (WSP, ISOTYPE of ***Xylaria arbuscula*** *var.* ***plenofissura***); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082301 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072323, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072318, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072311, wood (JDR); Ping-tung Co., Heng-chun, Kong-ko, 24.VIII.1988, Ju, Y.-M., 77082402 (CULTURED), wood (JDR); Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062103, wood (JDR).

ADDITIONAL SPECIMENS EXAMINED: PARAGUAY: Cerra Nigro, 8.I.1893, Malme 415, wood (S, SYNTYPE of ***X. juniperus** var.* ***asperula***); Mbopy, 9.XI.1893, Malme, wood (S, SYNTYPE of ***X. juniperus** var.* ***asperula***).

NOTES: This fungus has ascospores (15.5-)16-19 x 5.5-7 μm, between the size ranges of ***X. arbuscula*** and ***X. apiculata***. It can be considered to be a variety of either species or to be a distinct species. Dennis (1958) synonymized ***X. juniperus** var.* ***asperula*** with ***X. apiculata***. In the same work, he also treated ***X. venosula*** Speg. as a synonym of ***X. apiculata***. ***Xylaria juniperus*** Starb. *var.* ***asperula*** Starb. [Bih. Kongl. Svenska Vetensk.-Akad. Handl. 27, 3: 20. 1901.] is undoubtedly an earlier synonym of ***X. arbuscula** var.* ***plenofissura***. We have not seen the type of ***X. venosula*** which, according to Saccardo (1891), has the ascospore size range 14-18 x 6-7 μm and may represent an earlier name of this taxon. We refer to this fungus as ***X. arbuscula** var.* ***plenofissura*** until its associated nomenclatural and taxonomic problems are resolved.

Xylaria areolata (Berk. & M. A. Curtis) Y.-M. Ju & J. D. Rogers, *comb. nov.*
Figs. 14-16, 40

≡ ***Hypoxylon areolatum*** Berk. & M. A. Curtis *apud* Berk., J. Linn. Soc., Bot. 10: 384. 1869; *non* Starb., 1905.

≡ ***Penzigia areolata*** (Berk. & M. A. Curtis) J. H. Miller, Monogr. of the World Species of ***Hypoxylon***, p. 132. 1961.

Stromata hemispherical, 4-8 mm diam x 2.5-4 mm high; surface plane, overlain with white scales; carbonaceous immediately beneath surface; white, soft between and beneath perithecia. Perithecia obovate, 0.5-0.7 mm diam x 0.8-1 mm high. Ostioles papillate. Asci eight-spored, cylindrical, 320-360 μm total length x 11-13 μm broad, the spore-bearing part 200-230 μm long, with apical ring bluing in Melzer's iodine reagent, urn-shaped or coffin-shaped, 10-13 μm high x 5-5.5 μm broad. Ascospores blackish brown, unicellular, ellipsoid-inequilateral, with broadly rounded ends, 28-33 x 8.5-10 μm, with a noncellular, hyaline appendage 2-3 μm long on each end, with straight germ slit nearly spore-length on the concave side.

Colonies covering Petri dish in 3 wk, at first whitish, velvety, azonate, with entire margins, becoming overlain with irregular blackish patches. Reverse uncolored. Stromata distributed at periphery of colonies, pulvinate, 0.5-1 cm diam, at first white, becoming blackish. Anamorph not produced.

SPECIMEN EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082008 (CULTURED), wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: CUBA: Wright, C. 586 [= Fung. Cub. Wright. 824], corticated wood (FH [2 pks.], ISOTYPE of ***Hypoxylon areolatum***).

NOTES: This is a penzigioid ***Xylaria***. The white scales on the stromatal surface are diagnostic. No anamorph was formed in culture.

Xylaria atrosphaerica (Cooke & Massee) Callan & J. D. Rogers, Mycotaxon 36: 349. 1990. Fig. 55

See Rogers et al. (1987) and Callan and Rogers (1990) for descriptions of the teleomorph.

Colonies covering Petri dish in 2.5 wk, at first whitish, velvety, appressed, zonate, with raised radiating ridges and lobed margins; browning on the ridges and surrounding area. Stromata sporadically distributed, often densely aggregated at edge of colony, cylindrical, up to 5 mm high x 0.7 mm diam at base, branched or unbranched, initially white, turning brownish later. Anamorph not produced on OA, but on SMEA. Sporulating regions on the upper surfaces of stromata. Conidiophores in upright palisades, dichotomously branched several times from base, olivaceous brown, smooth. Conidiogenous cells terminal, cylindrical, 10-25 x 3-4 μm, hyaline to pale brown, smooth, bearing lateral and terminal discoid conidial secession scars ca. 0.5 μm high x 0.8 μm diam. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (gray to olive in masses), smooth, ellipsoid to obovate, 6-7.5 x 2.5-3.3 μm, with flattened base 0.8-1 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082224 (CULTURED), wood (JDR).

NOTES: The cultural data, along with stromatal features and ascospore characteristics, show this fungus to be closely allied to the ***X. polymorpha*** complex. Callan and Rogers (1990) described cultures from a French Guiana collection that showed yellow pigmentation in colonies and produced larger conidia than those from the Taiwan material.

Xylaria badia Pat., J. Bot. (Morot) 5: 319. 1891.
= ***Xylaria timorensis*** C. G. Lloyd, Mycol. Writings 6: 896. 1919.

Stromata unbranched or branched at base, cylindrical, with narrowly rounded fertile apices, bearing immersed perithecia, usually on short stout pubescent stipes, 1.5-2.5(-3.5) cm total length x 2-4 mm diam; surface ochraceous, coriaceous at first, becoming dark brown, carbonaceous, smooth; ochraceous, soft between and beneath perithecia. Perithecia spherical, ca. 0.2 mm diam. Ostioles papillate. Asci eight-spored, cylindrical, 100-120 μm total length x 5-6 μm broad, the spore-bearing part 60-70 μm long, with apical ring bluing in Melzer's iodine reagent, flattened discoid, 1 μm high x 1.5-2 μm broad. Ascospores light brown, unicellular, ellipsoid, with broadly rounded ends, 9-10 x 3.5-4 μm, with straight germ slit much less than spore-length.

SPECIMEN EXAMINED: Tainan Co., Nan-hsi, 21.VII.1985, Ju, Y.-M., PPE-107, culms of ***Bambusa stenostachya*** (JDR).

ADDITIONAL SPECIMENS EXAMINED: VIETNAM: Tonkin, Ke So, no. 436 & 4417, wood (FH, SYNTYPES of ***Xylaria badia***). FRENCH GUIANA: Leprieur 1412 (K, ISOTYPE of ***Xylaria myosurus***).

NOTES: The type of ***X badia*** has slightly larger ascospores, 9.5-12 x 4-4.5 µm, than our material, but is otherwise identical. The type of ***X. timorensis*** was based on immature material (Lloyd, 1919). The present fungus was collected from a bamboo culm, as was the material of ***X. timorensis*** described by Lloyd from the Philippines. ***Xylaria bambusae*** Pande, reported by Kamat and Pande (1975) in India on bamboo, appears to be the same as ***X. badia***; however, we have not seen its type material. No culture was obtained from the Taiwan material. Van der Gucht (1995, 1996) recently reported ***X. badia*** from Papua New Guinea and described its cultures and anamorph. Ju and Tzean (1985b) identified ***X. badia*** as ***X. myosurus*** Mont. The type of ***X. myosurus*** at K has stromata that are sessile and have tapered apices. We did not observe a germ slit on the ascospore which may be lacking or extremely faint.

Xylaria bambusicola Y.-M. Ju & J. D. Rogers, *sp. nov.* Figs. 17, 18, 41

Etymology: After the substrate on which the fungus inhabits

Stromata indivisa vel ramosa, dense gregaria, cylindrica, interdum complanata, plerumque apicibus acutis sterilibus, 1.5-6(-9) cm longa x 1.5-2.5(-3.5) mm crassa, partibus fertilibus 1-3 cm longis, in brevibus vel longis tomentosis stipitibus; extus atra cum superficie dehiscenti fulva vel fusca, levia praeter tumulos peritheciorum; intus alba; textura carbonacea sub superficie dura. Perithecia sphaerica, 0.3-0.5 mm diam. Ostiola elevata plerumque umbilicata. Asci octospori, cylindrici, stipitati, 120-150(-175) µm longitudine tota x 5.5-7 µm crassi, partibus sporiferis 60-75 µm, annulo apicali in liquore iodato Melzeri cyanescente, inverse petasiformis, 2.5-3 µm alto x 2.5-2.8 µm lato. Ascosporae brunneae, unicellulares, ellipsoideo-inequilaterales apicibus angustatis interdum uno extremo cum minuta hyalina cellulari appendicula, 9.5-11(-12.5) x 4-5 µm, rima germinativa longa recta praeditae.

Stromata unbranched or branched, densely gregarious, cylindrical sometimes flattened, usually with acute sterile apices, 1.5-6(-9) cm total length x 1.5-2.5(-3.5)mm diam, the fertile parts 1-3 cm long, on short to long tomentose stipes; surface blackish, with ochraceous brown to dark brown dehiscent outer layer, smooth except for conspicuous perithecial mounds; interior white; carbonaceous, beneath surface hard. Perithecia spherical, 0.3-0.5 mm diam. Ostioles raised, usually umbilicate. Asci eight-spored, cylindrical, stipitate, 120-150(-175) µm total length x 5.5-7 µm broad, the spore-bearing part 60-75 µm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 2.5-3 µm high x 2.5-2.8 µm broad. Ascospores brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends sometimes bearing a tiny hyaline cellular appendage on one end, 9.5-11(-12.5) x 4-5 µm, with straight spore-length germ slit.

Colonies covering Petri dish in 3 wk, at first whitish, velvety, appressed, faintly zonate, with entire margins, then turning gray to blackish. Reverse uncolored. Stromata produced on entire surface of colony, especially abundant at periphery, unbranched or branched several times, cylindrical, 0.5-1.5 μm diam at base, initially white, becoming blackish from base upwards. Teleomorph induced in culture by transferring the stromata produced on OA to SMEA, with morphological features as described for the teleomorph collected in field. Sporulating regions on the upper surfaces of stromata. Conidiophores in upright palisades, di- or trichotomously branched several times from base, pale brown, smooth. Conidiogenous cells terminal, cylindrical, 7-14 x 2-2.5 μm, yellowish, smooth, bearing terminal denticulate conidial secession scars ca. 0.5 μm high x 0.5 μm broad at base. Conidia produced holoblastically in sympodial sequence. Conidia hyaline to yellowish (vivid yellow in masses), smooth, ellipsoid, usually asymmetrical with a faint apical beak, 3.5-5 x 1.5-2 μm, with flattened base 0.7 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 27.VII.1986, Ju, Y.-M., PPE-183, culms of bamboo (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091409 (CULTURED), culms of bamboo (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 5.IX.1987, Ju, Y.-M., 76090502 (CULTURED), culms of ***Bambusa oldhamii*** (WSP, HOLOTYPE of ***Xylaria bambusicola***); Nan-tou Co., Lu-ku, Shi-tou, 25.X.1985, Ju, Y.-M., PPE-111, culms of bamboo (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082237, culms of ***Phyllostachys pubescens*** *var.* ***pubescens*** (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082208, culms of ***Phyllostachys pubescens*** *var.* ***pubescens*** (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082207, culms of ***Phyllostachys pubescens*** *var.* ***pubescens*** (JDR); Ping-tung Co., Heng-chun, Kong-ko, 24.VIII.1988, Hsieh, H.-M., 77082403 (CULTURED), culms of bamboo (JDR).

NOTES: This fungus grows on the interior softer side of bamboo culms. The yellow conidia and host specificity are distinct from other taxa in the ***X. arbuscula*** complex. It differs from ***X. arbuscula*** in having smaller ascospores and in having a spore-length ascospore germ slit. The anamorphic features are similar to those of ***X. arbuscula***. Cannon and Whalley (1988) described a ***Xylaria*** associated with bamboo cane in a British hothouse and suggested that it belongs to the ***X. hypoxylon*** (L.) Grev. complex. That fungus has ascospores 12-13.5(-15.5) x 4-5.5 μm, larger than the Taiwan fungus. Furthermore, unlike the Taiwan fungus, their fungus has an ascospore germ slit less than spore-length. Unfortunately, no anamorphic data are available for the British hothouse fungus.

Xylaria berteri (Mont.) Cooke, Grevillea 11: 126. 1883.

See Callan and Rogers (1990) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091416, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091415, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 27.VI.1984, Ju, Y.-M., 73062701, twig (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082215 (CULTURED), wood (JDR); Taipei Co., Sun-shai, 9.IX.1988, Ho, S.-M., 77090901 (CULTURED), wood (JDR);

Taipei Co., Wu-lai, 21.VI.1988, Ju, Y.-M., 77062101 (CULTURED), wood (JDR).

NOTES: This penzigioid fungus has surface characteristics similar to those taxa in the ***X. cubensis*** complex. Its cultural morphology also provides additional evidence to this relatedness.

Xylaria consociata Starb., Bih. Kongl. Svenska Vetensk.-Akad. Handl. 27, 3: 17. 1901. Fig. 57

Stromata densely aggregated, branched from the pannose base or above, cylindrical to somewhat flattened, with flattened sterile apices, on short to long slender pubescent stipes, 2-5(-7) cm total length x 1.5-2.5 mm diam; surface blackish, overlain with dark brown outer peeling layer, with conspicuous perithecial mounds, smooth; carbonaceous immediately beneath surface; whitish, hard between and beneath perithecia; interior becoming hollow. Perithecia spherical, 0.5-0.6 mm diam. Ostioles finely conical. Asci eight-spored, cylindrical, stipitate, 90-110 μm total length x 5-6 μm broad, the spore-bearing part 60-70 μm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 2-2.5 μm high x 1.8-2.2 μm broad. Ascospores brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, (9.5-)10-11(-11.5) x 3.5-4.5 μm, with straight germ slit spore-length.

Colonies covering Petri dish in 2 wk, at first white, velvety, appressed, zonate, with narrowly plumose margins, becoming blackish and overlain with white hyphal tufts at some places. Reverse brownish. Sporulating regions at periphery of colony in small tufts. Conidiophores in upright palisades, dichotomously branched several times from base, smooth, yellowish. Conidiogenous cells terminal, cylindrical, 10-20 x 2.5-3.5 μm, smooth, bearing lateral and terminal denticulate conidial secession scars ca. 0.5 μm high x 0.7 μm broad. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (grayish in masses), smooth, fusoid-inequilateral, 10-14.5(-16.5) x 2.5-3 μm, with flattened base ca. 1 μm broad indicating former point of attachment to conidiogenous cell. Some conidia with outer wall swelling at apex.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082306 (CULTURED), wood (JDR).

NOTES: The material looks very much like Lloyd's (1920) photograph of ***X. consociata***. It resembles ***X. multiplex*** in ascospore size and the caespitose habit of stromata. Colony morphology also supports their relatedness. The flattened sterile apices of stromata seem of diagnostic value for ***X. consociata***. Teng (1935) reported this fungus from Yunnan, China.

Xylaria cubensis (Mont.) Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 126. 1851. Figs. 19-21

See Rogers (1984) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091420, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091417, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-085, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-079, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091116, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082302 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072319, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072317, wood (JDR); Ping-tung Co., Heng-chun, Kong-ko, 24.VIII.1988, Ju, Y.-M., 77082406 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Nan-zien-shan, 10.IX.1991, Ju, Y.-M., 80091018, wood (JDR); Tai-tung Co., Lan-yuh, Ta-san-shan, 20.V.1988, Hsieh, H.-M., 77052002 (CULTURED), wood (JDR); Taipei City, Chi-shinn-shan, 15.V.1984, Ju, Y.-M., PPE-073, wood (JDR); Taipei Co., Wu-lai, III.1986, Ju, Y.-M., 75030001, wood (JDR).

NOTES: The anamorph of the Taiwan ***X. cubensis*** fits ***Xylocoremium flabelliforme*** (Schwein.: Fr.) J. D. Rogers (Rogers, 1984) well in microscopic features. The conidial masses, however, are whitish gray rather than pinkish as reported in Rogers (1984) and Rogers and Samuels (1986). It is possible that this difference in conidial color represents divergence in the species over time and long geographic separation of populations. A somewhat similar phenomenon is found in ***X. allantoidea*** among collections from Taiwan (see ***X. allantoidea*** herein). Also compare with ***X. laevis*** herein.

Specimen 85101102 [I-lan Co., Ta-tung, Chi-lan-shan, 11.X.1996, Ju, Y.-M., 85101102 (CULTURED), wood (JDR)] is a hypoxyloid form of ***X. cubensis*** with stromata discoid and not constricted at base. The colonies and anamorph are identical to those from the collections with erect stromata.

Xylaria curta Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 126. 1851.
Fig. 56

The teleomorph and cultures are as described by Callan and Rogers (1990) for a tropical collection.

Teleomorph induced in culture by transferring the stromata produced on OA to SMEA, with morphological features as the teleomorph collected in field. Sporulating regions on upper surfaces of stromata. Conidiophores in upright palisades, di- or trichotomously branched several times from base, smooth, brownish, becoming paler upwards, 3-4 μm broad. Conidiogenous cells terminal, cylindrical, 7-13(-18) x 3-3.5 μm, hyaline to pale olivaceous brown, smooth, bearing lateral and terminal crater-like conidial secession scars ca. 0.3 μm high x 0.7 μm diam. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth to finely roughened, ellipsoid, 7-8.5(-9) x 3-4 μm, with flattened base 1-1.2 μm broad indicating former point of attachment to conidiogenous cell. Conidia germinating in culture.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091414, wood (JDR); I-lan Co., Ta-tung, Chi-lan-shan, 22.XI.1988, Ju, Y.-M., 77112202 (CULTURED), wood (JDR); Nan-tou Co., Huei-sun, 22.IV.1985, Ju, Y.-M., PPE-092, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-082, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082308 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072309, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072308 (CULTURED), wood (JDR); Tao-yuan Co., Loung-tam, 10.XII.1987, Ju, Y.-M., 76121001 (CULTURED), wood (JDR).

NOTES: Callan and Rogers (1990) discussed ***X. curta*** and compared a tropical collection with a temperate collection The temperate collection is now considered to be ***X. corniformis*** (Fr.: Fr.) Fr. (Callan and Rogers, 1993). The teleomorph of the present collections and their ***X. curta*** are quite similar, as are the gross morphologies of cultures. Unfortunately, the cultures of Callan and Rogers (1990) did not yield an anamorph; neither did the cultures that Van der Gucht (1996) recently described from Papua New Guinea. Ju and Tzean (1985b) reported this fungus as ***X. feejeensis*** (Berk.) Fr. which is very similar.

Xylaria fissilis Ces., Atti Accad. Sci. Fis. 5: 16. 1872.

Stromata as described by Rogers et al. (1987). Ascospores brown, unicellular, fusoid-inequilateral to crescentic, smooth, 14-16.5 x 4.5-5.5(-6.5) μm, with straight germ slit less than spore-length.

SPECIMENS EXAMINED: Hsin-chu Co., Chien-shih, Ta-ba-chien-shan, 25.VIII.1988, Yeh, T.-Y., 77082501, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 27.VII.1984, Ju, Y.-M., PPE-104, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 19.XI.1983, Ju, Y.-M., PPE-064, wood (JDR); Tao-yuan Co., Fu-hsin, La-la-shan, 15.XI.1986, Ju, Y.-M., PPE-187, wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: MALAYSIA: Sarawak, 1865, Beccari, O. 248, wood (RO, HOLOTYPE of ***X. fissilis***).

NOTES: The present material is much as the holotype material. This fungus has been reported by Ju and Tzean (1985b) in Taiwan.

Xylaria formosana Y.-M. Ju & S.-S. Tzean, Trans. Mycol. Soc. R.O.C. 1: 112. 1985.

See Ju and Tzean (1985b) for a description of the teleomorph.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091411, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-078, wood (WSP, ISOTYPE of ***Xylaria formosana***).

NOTES: This fungus is characterized by blackish ascospores with abruptly narrowed ends. The stromatal characteristics indicate ***X. formosana*** to be a member of the ***X. polymorpha*** complex. Unfortunately, we were unable to obtain cultures.

Xylaria frustulosa (Berk. & M. A. Curtis) Cooke, Grevillea 12: 5. 1883.

See Jong and Rogers (1970) [as ***Penzigia frustulosa*** (Berk. & M. A. Curtis) J. H. Miller] for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091105 (CULTURED), wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: CUBA: Wright, C. 497, wood (FH, ISOTYPE of ***Hypoxylon frustulosum***).

Xylaria glebulosa (Ces.) Y.-M. Ju & J. D. Rogers, *comb. nov.*
Figs. 22, 23, 42, 60

≡ ***Hypoxylon glebulosum*** Ces., Atti Accad. Sci. Fis. 8: 17. 1879.

Stromata scattered to gregarious, pulvinate to spherical, with flattened to slightly convex top, on narrow central connective, 1.5-2(-3) mm high x 1-3 mm diam; surface dark brown to black, conspicuously reticulately cracked, lacking perithecial mounds; carbonaceous immediately beneath surface; whitish, hard between and beneath perithecia. Perithecia spherical, 0.6-0.8 mm diam. Ostioles faint to hemispherical. Asci eight-spored, with spores arranged in uniseriate or partially biseriate manner, cylindrical to clavate-cylindrical, stipitate, 210-240 μm total length x 11-15 μm broad, the spore-bearing part 140-170 μm long, with apical ring bluing in Melzer's iodine reagent, urn-shaped, 8-11 μm long x 5-6 μm broad. Ascospores dark brown, unicellular, ellipsoid-inequilateral, frequently with abruptly pinched ends, 27-31 x 8-10 μm, with oblique germ slit much less than spore-length.

Colonies covering Petri dish in 4 wk, at first white, velvety to felty, appressed, zonate, with entire or slightly lobed margins, becoming blackish. Reverse uncolored. Stromata arranged in irregular concentric rings, pulvinate to cylindrical, up to 7 mm high x 1 mm diam at base, at first pinkish, becoming black. Teleomorph induced in culture by transferring the stromata produced on OA to SMEA, with morphological features as described for the teleomorph collected in field. Conidiophores not found on stromata growing on OA, but on those growing on SMEA. Sporulating regions on the upper surfaces of stromata. Conidiophores in upright palisades, di- or trichotomously branched several times from base, olivaceous brown, smooth. Conidiogenous cells proliferating indeterminately, cylindrical, 13-25 x 4-5 μm, subhyaline, smooth, bearing lateral and terminal discoid to dome-shaped conidial secession scars ca. 0.5 μm high x 0.8 μm diam. Conidia produced holoblastically in sympodial sequence. Conidia pale olivaceous (olivaceous in masses), smooth to finely roughened, ellipsoid to fusoid, 8.5-11 x 3.5-4 μm, with narrowly rounded apices and flattened base 1 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091121, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082307 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072328, wood (JDR); Tao-yuan Co., Fu-hsin, La-la-shan, 15.XI.1986, Ju, Y.-M., 75111502, wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: SRI LANKA: Beccari, O. 122, wood (RO [2pks.], LECTOTYPE [selected by Ju and Rogers (1996)] of ***Hypoxylon glebulosum***).

NOTES: This is a penzigioid ***Xylaria***. The stromatal texture and the cultural morphology suggest that this taxon is closely allied to the ***X. polymorpha*** complex. The ascospore morphology of this fungus resembles that of ***X. formosana***.

Xylaria grammica (Mont.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1, p. 128. 1851.

See Ju and Tzean (1985b), Rogers et al. (1987), and San Martín and Rogers (1989) for descriptions of the teleomorph. Cultures are as described by Rogers et al. (1987).

SPECIMENS EXAMINED: Hwa-lien Co., Fen-ling, IX.1984, Jang, J.-C., PPE-109, wood (JDR); Miao-li Co., Shih-tou-shan, 21.VII.1985, Hsieh, S.-Y., PPE-105, wood (JDR); Nan-tou Co., Ho-sei, 5.XI.1988, Chou, W.-N., 77110501 (CULTURED), wood (JDR); Nan-tou Co., Huei-sun, 22.IV.1985, Ju, Y.-M., PPE-094, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080703 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082333, wood (JDR); Tao-yuan Co., Wu-ling, 11.VI.1986, Ju, Y.-M., PPE-184, wood (JDR).

NOTES: Rogers et al. (1987) described the anamorph of this fungus which has the largest conidia known for any species of ***Xylaria***. However, the anamorph described by Van der Gucht (1996) has smaller conidia. No anamorph was obtained from the Taiwan material.

Xylaria cf. heliscus (Mont.) J. D. Rogers & Y.-M. Ju, Mycotaxon 68: 370. 1998.

Stromata densely aggregated, branched one to several times from base or above, peltate, flat-topped, on short to long, frequently pubescent, stipes, 2.5-4(-25) mm total length x 1.5-2 mm broad; surface dark brown, corky-cracked on top and warted on sides, smooth; carbonaceous immediately beneath surface; white, soft between and beneath perithecia. Perithecia spherical, 0.3-0.4 mm diam. Ostioles papillate, often at center of a small disc ca. 0.1 mm diam. Asci eight-spored, cylindrical, stipitate, 130-150 μm total length x 12-13.5 μm broad, the spore-bearing part 70-80 μm long, with apical ring faintly bluing in Melzer's iodine reagent, urn-shaped, 5 μm high x 3 μm broad. Ascospores dark brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, smooth, 11.5-12.5(-13.5) x 5.5-6.5(-7) μm, with straight germ slit slightly less than spore-length.

Colonies covering Petri dish in 2 wk, at first whitish, felty, azonate, with diffuse margins, then with moderately radiating furrows, becoming overlain with irregular blackish patches. Reverse uncolored. Stromata and conidiogenous structure not seen.

SPECIMENS EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082022, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091115, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 11.IX.1991, Ju, Y.-M., 80091114, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082315 (CULTURED), wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: NEW CALADONIA: Yahoué, wood (FH, HOLOTYPE of ***Kretzschmaria scruposa***).

NOTES: This fungus is much like ***X. heliscus*** described by Dennis (1957) and by Rogers et al. (1987) [both under ***Kretzschmaria***] except for the slightly larger ascospores. The type material appears to fit the type material of ***Kretzschmaria scruposa*** Har. & Pat. We are uncertain whether or not ***K. scruposa*** is a synonym of ***X. heliscus***.

Xylaria ianthinovelutina (Mont.) Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 128. 1851. Fig. 58

See San Martín and Rogers (1989) for a description of the teleomorph. It is added here that ascospores bear a hyaline noncellular appendage on each end.

Colonies covering Petri dish in 3-4 wk, at first whitish, velvety, appressed, zonate, with lobed margins, later with alternately yellow green and dark green concentric rings from center outwards. Reverse brownish. Stromata arising from dark green concentric rings, cylindrical, up to 1 mm diam at base, unbranched or branched once to several times at point of contact with lid of Petri dish, initially pinkish, soon becoming blackish from base upwards. Sporulating regions on upper surface of stromata. Conidiophores in upright palisades, dichotomously branched several times from base, brown, smooth. Conidiogenous cells terminal, cylindrical, 10-20 x 2.5-3.5 μm, hyaline, finely roughened, bearing lateral and terminal denticulate conidial secession scars ca. 0.5 μm high x 0.5 μm broad at base. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (white in masses), smooth to faintly striate, obovate, 4.5-6(-6.5) x 2-2.5 μm, with flattened base 0.7 μm broad indicating former point of attachment to conidiogenous cell.

Another type of colony, obtained from a sector of the above described colonies, is described below.

Colonies covering Petri dish in 6 wk or never reaching the edge of Petri dish, at first whitish, velvety, appressed, zonate, with lobed margins; becoming purplish red, then blackish, with densely furrows radiating from the center of colonies. Reverse brownish. Stromata and anamorphic structures not produced.

SPECIMENS EXAMINED: Miao-li Co., Gin-suei, 20.IV.1988, Chen, Z.-C., 77042001 (CULTURED), wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082210 (CULTURED), wood (JDR).

ADDITIONAL SPECIMENS EXAMINED: CUBA: sent by Montagne to Berkeley (K, TYPE of ***Hypoxylon dichotomum***). HONDURAS: Tela, 9.II.1923, Reinking, O.A., decaying palm (BPI [Lloyd herb.], TYPE of ***Xylaria bambooensis***).

NOTES: ***Xylaria ianthinovelutina*** and ***X. juruensis*** are apparently closely related. Also see NOTES on ***X. juruensis***. Ju and Tzean (1985b) reported this fungus as ***X. dichotoma*** (Mont.) Fr. which differs from ***X. ianthinovelutina*** in having smaller perithecia and in having paler ascospores, and in lacking noncellular ascospore appendages. ***Xylaria bambooensis*** C. G. Lloyd is a synonym of ***X. dichotoma***.

Xylaria intracolorata (J. D. Rogers, Callan, & Samuels) J. D. Rogers & Y.-M. Ju, Mycotaxon 68: 372. 1998.

See Rogers et al. (1987) [under ***Kretzschmaria***] for a description of the teleomorph. See Rogers and Ju (1998) for a description of the anamorph.

SPECIMENS EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082225 (CULTURED), wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082211 (CULTURED), wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: INDONESIA: North Sulawesi, Dumoga-Bone National Park, vic. 'Camp Edwards', 0°35'N, 123°51'E, elev. 664 m, X.1985, Samuel, G.J. 2079, recently fallen tree (JDR, ISOTYPE of ***Kretzschmaria intracolorata***).

NOTES: The teleomorph of the Taiwan material generally is as described by Rogers et al. (1987).

Xylaria juruensis Henn., Hedwigia 43: 262. 1904.

See Rogers et al. (1987) for a description of the teleomorph. Colonies and anamorph are as in ***X. ianthinovelutina***. Teleomorph was induced in culture by transferring stromata produced on OA to SMEA, having morphological features as in the teleomorph collected from field.

SPECIMEN EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091404 (CULTURED), fronds of ***Calamus*** (JDR).

ADDITIONAL SPECIMEN EXAMINED: BRAZIL: Rio Juruá, Juruá Miry, VI.1901, Ule, E., monocot (S, ISOTYPE of ***Xylaria juruensis***). INDONESIA: North Sulawesi, Dumonga-Bone National Park, 24.X.1985, Samuels, G. J. 2367, palm leaf midrib, as ***Xylaria juruensis*** (JDR).

NOTES: This fungus appears to be closely related to ***X. ianthinovelutina***. They have similar stromatal habits, i.e., half-exposed perithecia, dark hairs covering entire stromatal surface, and sterile apices. Their relatedness is reinforced by the striking similarity in cultures. Both produced green, zonate colonies and have the same anamorphic features. ***Xylaria juruensis*** differs from ***X. ianthinovelutina*** in having larger ascospores and in frequently producing penzigioid stromata. In addition, ***Xylaria juruensis*** has been collected only from monocots.

Xylaria laevis C. G. Lloyd, Mycol. Writings 5: 8. 1918. Fig. 61

Stromata cylindrical to clavate, with rounded fertile apices and ill-defined stipes, 3-3.7 cm total length x 1.8-2.8 cm diam; surface dark copper brown to blackish brown, shiny, smooth; carbonaceous immediately beneath surface; white, soft between and beneath perithecia; interior becoming hollow. Perithecia spherical, 0.7-0.8 mm diam. Ostioles papillate. Asci eight-spored, cylindrical, stipitate, 140-155 μm total length x 5-6 μm broad, the spore-bearing part 55-65 μm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 1-1.5 μm high x 2-2.5 μm broad. Ascospores brown, usually with a minute hyaline cell on one end, unicellular, short fusoid, with narrowly rounded ends, (8.5-)9-10.5(-11) x 4-5 μm, with straight germ slit spore-length.

Colonies covering Petri dish in 2 wk, at first whitish to pinkish, floccose, zonate, with cottony margins, forming a dark layer on agar surface. Reverse grayish. Stromata mostly produced at the center of colony, cylindrical, 2-3 mm diam at base, branched at points of contact with lid of Petri dish, initially pinkish, soon becoming olivaceous from base upwards, then covered with grayish olive conidial masses. Sporulating regions on the upper surface of stromata. Conidiophores in upright palisades, di- or trichotomously branched several times from base, olivaceous brown, smooth. Conidiogenous cells terminal, cylindrical, 20-30 x 2.5-3 μm, hyaline, finely roughened, bearing lateral and terminal denticulate conidial secession scars, ca. 0.5 μm high x ca. 0.8 μm broad at base. Conidia produced holoblastically in sympodial sequence. Conidia subhyaline to pale olivaceous, smooth, ellipsoid to obovate, 5.5-7(-8) x 2.8-3.5 μm, with flattened base ca. 0.8 μm broad indicating former point of attachment to conidiogenous cell. Some conidia with flattened apices or small, corona-like apical processes.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 22.XI.1988, Ju, Y.-M., 77112201 (CULTURED), wood (JDR); Miao-li Co., Shih-tou-shan, 21.VII.1985, Hsieh, S.-Y., PPE-106, wood (JDR); Taipei Co., Wu-lai, 10.VII.1985, Ju, Y.-M., PPE-099, wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: SOLOMON ISLANDS: Russell Island, Cheel, E., wood (BPI 12465, HOLOTYPE of ***X. laevis***).

NOTES: ***Xylaria laevis*** is closely allied to ***X. allantoidea*** and ***X. cubensis***. It has an ascospore size range similar to ***X. cubensis***, but smaller than ***X. allantoidea***. Unlike ***X. cubensis***, ***Xylaria laevis*** has short fusoid ascospores on which a conspicuous germ slit and a cellular appendage are usually found. Conidia of ***X. laevis*** often have a flattened apex or small, corona-like apical process which is also sometimes found on those of ***X. allantoidea***, but not on those of ***X. cubensis***. Thus, ***Xylaria laevis*** seems to represent a distinct species but possesses characteristics intermediate between ***X. allantoidea*** and ***X. cubensis***. Ju and Tzean (1985b) recorded those specimens assignable to ***X. laevis*** as "type A" under ***X. cubensis***, and left those specimens being typical ***X. cubensis*** as "type B" under ***X. cubensis***. Van der Gucht (1995) recently reported ***X. laevis*** from Papua New Guinea.

Xylaria leprosa Speg., Bol. Acad. Nac. Ci. Cordoba 11: 515. 1889.

See Martin (1970) and Ju and Tzean (1985b) for descriptions of the teleomorph.

SPECIMEN EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 27.VII.1984, Ju, Y.-M., PPE-069, wood (JDR).

NOTES: ***Xylaria leprosa*** is similar to ***X. scruposa*** but differs from the latter in having shorter ascospores with broadly rounded ends and in having a longer germ slit. It is also similar to ***X.*** *cf.* ***corniculata*** Sacc. described by San Martín and Rogers (1989) except for having broadly rounded ends on the ascospore.

Xylaria melanaxis Ces., Atti Accad. Sci. Fis. 8: 16. 1879.

The teleomorph is as described by Rogers et al. (1987) [as ***X.*** *cf.* ***melanaxis***]. Ascospores are somewhat laterally flattened, 4.5-5 x 2.5-3.2 x 2-2.5 μm.

Colonies covering Petri dish in 5 days, at first dilute, azonate, with diffuse margins, becoming cottony, light yellowish brown. Reverse uncolored. Stromata arising sporadically, grotesque, unbranched or branched and digitate, up to 9 mm high x 0.5-1.5 mm diam at base, black on surface. Sporulating regions on the upper surface of stromata. Conidiophores in upright palisades, dichotomously branched several times from base, hyaline to pale brown, smooth. Conidiogenous cells terminal, cylindrical, 7-15 x 2.5-3 μm, hyaline, smooth, bearing terminal denticulate conidial secession scars ca. 0.5 μm. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (mouse gray in masses), smooth, ellipsoid, 4-4.5 x 2.5-3 μm, with a flattened base ca. 0.7 μm indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: Taipei City, Young-ming-shan, 12.VIII.1996, Li, M.-F., sent by Wang, Y.-Z., 85081201 (CULTURED), soil (JDR).

ADDITIONAL SPECIMENS EXAMINED: INDONESIA: North Sulawesi, Dumoga-Bone National Park, vic. "Hog' Back Camp", elev. 492 m, 30,31.X.1985, Samuels, G. J. 2469, on ground, as ***Xylaria cf . melanaxis*** (JDR). MALAYSIA: Sarawak, Beccari, O. 217, soil (RO, HOLOTYPE of ***Xylaria melanaxis***).

NOTES: The Taiwan collection fits well the holotype material. The material described from Sulawesi, Indonesia seems in a younger stage and thus has a white to yellowish white stromatal surface. The stromata produced in culture are largely composed of hyaline, swollen cells.

Collection 76071101 [Taipei City, Nei-hoo, 11.VII.1987, collector unknown, termite nest (JDR)] is much like ***X. melanaxis*** but differs in having the poroid germination site on the convex side of the ascospore.

Xylaria moelleroclavus J. D. Rogers, Y.-M. Ju, & Hemmes, Mycol. Res. 101: 345. 1997.

See Rogers et al. (1997) for descriptions of the teleomorph and anamorph.

SPECIMEN EXAMINED: Tao-yuan Co., Pa-linn, 7.III.1980, collector unknown, 69030701, wood (JDR).

Notes: This fungus has the ascospore morphology typical for the ***X. polymorpha*** complex, but the anamorphic state is unlike the species of that complex. The teleomorph is characterized by hollow stromata and a wrinkled but continuous surface. It has often been identified as ***X. scruposa***.

Xylaria multiplex (Kunze: Fr.) Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 127. 1851.

See Ju and Tzean (1985b) and San Martín and Rogers (1989) for descriptions of the teleomorph. Van der Gucht (1996) has described the cultures and anamorph.

Colonies covering Petri dish in 2 wk, at first white, velvety, appressed, zonate, with narrowly plumose margins, becoming blackish from center outwards and gradually overlain with whitish floccose hyphae. Reverse uncolored. Stromata and anamorph not produced.

SPECIMENS EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-077, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082305 (CULTURED), wood (JDR).

NOTES: It differs from ***X. consociata*** mainly in having mucronate or acute, rather than flattened, stromatal apices.

Xylaria obovata (Berk.) Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 127. 1851.

See Ju and Tzean (1985b) for a description of the teleomorph. Cultural and anamorphic features are as in ***X. schweinitzii*** (Rogers and Callan, 1986).

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 5.IX.1987, Ju, Y.-M., 76090501 (CULTURED), wood (JDR); Taipei Co., Wu-lai, 11.VII.1985, Ju, Y.-M., PPE-102, wood (JDR); Taipei Co., Wu-lai, 10.VII.1985, Ju, Y.-M., PPE-098, wood (JDR).

NOTES: This fungus is a member of the ***X. polymorpha*** complex, being characterized by stromata with a plane, finely cracked surface, hollow interior, and obovate fertile part.

Xylaria papillata Syd. *apud* De Wildeman, Fl. Bas et Moyen Congo 3, fasc. 1, Extra, p. 18. 1909.

Stromata unbranched, scattered or densely aggregated, spherical to turbinate, bearing immersed perithecia, with apices obtuse, sterile, and stipes reduced to a narrow central connective, 0.8-1 mm high x 1-1.5 mm diam; surface blackish, overlain with brown outer peeling layer, smooth; carbonaceous immediately beneath surface; whitish, soft between and beneath perithecia. Perithecia spherical, ca. 0.6 mm diam. Ostioles slightly raised at center of a paler area 0.1-0.2 mm diam, usually with a central umbilicate opening. Asci eight-spored, cylindrical, stipitate, 140-160 μm total length x 8-10 μm broad, the spore-bearing part 90-100 μm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 2.5-3.5 μm high x 2.5-3 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid-inequilateral, with narrowly rounded to abruptly pinched ends, 17-19(-21) x 6.5-7.5(-8) μm, with straight germ slit less than spore-length.

Colonies covering Petri dish in 4 wk, at first whitish, velvety, faintly zonate, with diffuse margins, with surface becoming overlain with blackened patchy hyphal layer. Reverse uncolored. Stromata arising from entire colony, cylindrical, up to 10 mm high x 0.5 mm diam at base, branched at base or above, at first whitish, turning black on surfaces. Teleomorph induced in culture by transferring the stromata produced on OA to SMEA, with morphological features as described for the teleomorph collected in field. Sporulating regions on the upper surface of stromata. Conidiophores in upright palisades, dichotomously branched several times from base, brown, smooth. Conidiogenous cells terminal, cylindrical, 7-12 x 2.5-3 μm, hyaline, smooth, bearing terminal denticulate conidial secession scars ca. 0.5 μm high x 0.5 μm broad at base. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (white in masses), smooth, ellipsoid to oblong-ellipsoid, usually asymmetric with a faint apical beak, 4.5-6 x 1.5-2 μm, with flattened base 0.7 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: Taipei City, Young-ming-shan, 14.VII.1988, Ju, Y.-M., 77071404 (CULTURED), wood (JDR).

NOTES: This stunted fungus is a member of the ***X. arbuscula*** complex. ***Xylaria schreuderiana*** and ***X. papillata*** are similar in most features including stromatal and cultural characteristics, but are separable mainly on the ascospore size ranges. The anamorphic features of ***X. papillata*** are identical to those of ***X. schreuderiana*** described and illustrated by Rogers and Samuels (1986).

Xylaria papulis C. G. Lloyd, Mycol. Writings 6: 1055. 1921. Fig. 62
= ***Xylaria wulaiensis*** Y.-M. Ju & S.-S. Tzean, Trans. Mycol. Soc. R.O.C. 1: 108. 1985.

Stromata unbranched or branched at base, clavate to clavate-cylindrical, flattened or terete, bearing entirely immersed perithecia, with rounded apices, on short or long stipes, 4-12 cm total length x 1-3.5 cm diam; surface dark gray to blackish, smooth, sometimes with major cracks; carbonaceous immediately beneath surface; whitish, hard between and beneath perithecia; interior becoming hollow. Perithecia spherical, 0.6-0.8 mm diam. Ostioles papillate, located in sunken circular areas 0.2-0.3 mm diam. Asci eight-spored, cylindrical, stipitate, 170-205 μm total length x 5.5-6.5 μm broad, the spore-bearing part 75-85 μm, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 3-3.5 μm high x 2-2.5 μm broad. Ascospores brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 11-13.5 x 4-5 μm, with straight germ slit spore-length to nearly spore-length.

Colonies covering Petri dish in 2 wk, at first white, velvety, appressed, zonate, with lobed margins, turning olive-green from center outwards, with yellowish green radiating ridges. Reverse pale brownish. Stromata usually developing in the centers of colonies, dendroid, 1.5-2 mm diam at base, whitish first, becoming olivaceous from base upward. Sporulating regions on upper surfaces of stromata. Conidiophores in upright palisades, dichotomously branched several times from base, smooth, subhyaline. Conidiogenous cells terminal, cylindrical, 10-20(-25) x 3-4 μm, hyaline, smooth, bearing lateral and terminal discoid conidial secession scars, ca. 0.5 μm high x ca. 1 μm broad. Conidia produced holoblastically in sympodial sequence. Conidia subhyaline to pale olivaceous, smooth, ellipsoid, 8-10 x 3.5-4 μm, with flattened base ca. 1 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091406, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-075, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082303 (CULTURED), stump of ***Leucaena glauca*** (JDR); Taipei Co., Wu-lai, 10.VII.1985, Ju, Y.-M., PPE-100, wood (WSP, ISOTYPE of ***Xylaria wulaiensis***).

ADDITIONAL SPECIMENS EXAMINED: PHILIPPINES: Luzon, Mt. Maquiling, 3.X.1920, Reyes, J., wood, as ***X. allantoidea*** by Lloyd, C.G., as ***X. allantoidea*** var. ***papulis*** by Miller, J.H. (BPI 12238); Luzon, Mt. Maquiling, 28.IX.1920, Reinking, O.A., wood, as ***X. ovata*** by Lloyd, C.G., as ***X. allantoidea*** var. ***papulis*** by Miller, J.H. (BPI 10501).

NOTES: ***Xylaria papulis*** was originally described by Lloyd (1921) from China. The present materials fit his photographs very well. The type of ***X. papulis*** was not located at BPI. Two specimens identified as ***X. allantoidea var. papulis***, an unpublished recombination, by the late Dr. J. H. Miller were examined and appear to be in agreement with the Taiwan collections. The fungus has massive stromata like ***X. guyanensis*** (Mont.) Fr. but differs from the latter in having smaller ascospores and smaller ostiolar discs. The olive-green colonies of ***X. papulis*** are reminiscent of ***X. adscendens*** (Callan and Rogers, 1990) which also has the ostiole surrounded by a small disc. Ju and Tzean (1985b) reported this fungus as ***X. regalis*** Cooke in Taiwan. Van der Gucht (1995) recently reported ***X. papulis*** from Papua New Guinea.

Xylaria papyrifera (Link.: Fr.) Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 126. 1851.

The teleomorph is much as that of ***X. allantoidea*** (Berk.) Fr. except for having larger ascospores 16-19 x 5.5-6.5 μm.

SPECIMEN EXAMINED: I-lan Co., Ta-tung, Chi-lan-shan, 14.IX.1991, Ju, Y.-M., 80091403, wood (JDR).

ADDITIONAL SPECIMEN EXAMINED: BRAZIL: no date, Beyrich, wood (UPS, HOLOTYPE of ***Sphaeria papyrifera***).

NOTES: The Taiwan material fits well the type material except for having somewhat broader ascospores, 16-19 x 5.5-6.5 μm vs. 15-18.5 x 4-5.5 μm. Dennis (1957) reported that the fragments of the holotype at UPS yielded ascospores 15-17 x 4-5.5 μm. However, he considered ***X. papyrifera*** to be the correct name for ***X. allantoidea*** which usually has smaller ascospores (see elsewhere herein; also see Rogers, 1984; San Martín and Rogers, 1989).

Xylaria polymorpha (Pers.: Fr.) Grev., Fl. Edinen., p.355. 1824.

See Rogers and Callan (1986) for a description of the teleomorph. Rogers and Callan (1986) have described the anamorph.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 5.II.1988, Ju, Y.-M., 77020501, wood (JDR).

NOTES: ***Xylaria polymorpha*** has been reported by Sawada (1931) from southern Taiwan where both ***X. polymorpha*** and ***X. schweinitzii*** have been collected. Since his material has not been examined during this work, the identity of his fungus remains unknown. We did not obtain cultures from the Taiwan material.

Xylaria schreuderiana Van der Bijl, Ann. Uniw. Stellenbosch. 10: 3. 1932.

See Rogers and Samuels (1986) for descriptions of the teleomorph and anamorph.

Teleomorph induced in culture by transferring the stromata produced on OA to SMEA, with morphological features as described for the teleomorph collected in field.

SPECIMENS EXAMINED: Chia-yi Co., Wu-fong, A-lee-shan, 24.VII.1988, Hsieh, H.-M., 77072402 (CULTURED), dead stem of ***Eupatorium formosanum*** (JDR); Nan-tou Co., Lu-ku, Shi-tou, 27.VII.1984, Ju, Y.-M., PPE-071, wood (JDR).

NOTES: The Taiwan material, having ascospores 20-25 x 8-9(-9.5) μm and ascal apical ring 5-6 μm high x 4.5-5 μm broad, is much as described in Rogers and Samuels (1986). ***Xylaria schreuderiana***, apparently a taxon in the ***X. arbuscula*** complex, was considered to be a synonym of ***X. apiculata*** by Dennis (1958). This concept was followed by Ju and Tzean (1985b).

Herein, ***Xylaria schreuderiana*** is considered to be a taxon distinct from ***X. apiculata***, as considered by Rogers and Samuels (1986).

Xylaria schwackei Henn., Hedwigia 34: 108. 1895. Figs. 24-26, 44, 59

Stromata unbranched, cylindrical, with acute sterile apices, on slender pubescent stipes, 1-2.5 cm total length x 0.7-1 mm diam; surface blackish brown, with very conspicuous perithecial mounds, sometimes overlain with remnants of outermost layer and stiff hairs; carbonaceous immediately beneath surface; white, hard between and beneath perithecia. Perithecia spherical, 0.2-0.4 mm diam. Ostioles slightly raised, with a central umbilicate opening. Asci eight-spored, cylindrical, stipitate, 90-105 μm total length x 6-7 μm broad, the spore-bearing part 55-65 μm, with apical ring bluing in Melzer's iodine reagent, urn-shaped, 2.5-3.2 μm high x 2.5 μm broad. Ascospores brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, 10-11.5 x (4-)4.5-5 μm, with straight germ slit almost spore-length.

Colonies covering Petri dish in 4 wk, at first whitish, velvety to felty, zonate, with fimbriate margins, becoming overlain with irregular patches of olivaceous black hyphae. Reverse uncolored. Stromata scattered, flattened, with acute apices, ca. 0.5 mm diam at base, at first white, blackening from base upwards; anamorph produced after transferring stromata to SMEA. Sporulating regions on upper surface of stromata. Conidiophores upright in dense palisades, di- or trichotomously branched, brown, smooth. Conidiogenous cells terminal, cylindrical, 5-10(-15) x 2.5-3 μm, bearing terminal denticulate conidial secession scars, 0.5 μm high x 0.5 μm diam. Conidia produced holoblastically in sympodial sequence. Conidia hyaline (white in masses), smooth, obovate, 3-4 x 1.5-2 μm, with flattened base 0.5 μm broad indicating former point of attachment to conidiogenous cell.

SPECIMEN EXAMINED: Chia-yi Co., Wu-fong, A-lee-shan, 24.VII.1988, Hsieh, H.-M., 77072401 (CULTURED), twig (JDR).

ADDITIONAL SPECIMEN EXAMINED: BRAZIL: Rio de Janeiro, 10.VII.1887, Ule, E. 2029, wood (HBG, SYNTYPE of ***Xylaria schwackei***).

NOTES: This little fungus is characterized by stromata having conspicuous perithecial contours and by the outer layer that is worn off so early that one can only find the occasional remnants on mature stromata. Usually, the stromatal surface is ornamented with sparsely distributed stiff hairs. Its conidia are slightly shorter than the conidia in those taxa of the ***X. arbuscula*** complex, i.e., generally 4-6.5 x 1.5-2 μm.

Xylaria schweinitzii Berk. & M. A. Curtis, J. Acad. Nat. Sci. Philadelphia, ser. II, 2: 284. 1853.

See Rogers and Callan (1986) for descriptions of the teleomorph and anamorph.

SPECIMENS EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, X.1984, Ju, Y.-M., PPE-070, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 27.VII.1984, Ju, Y.-M., PPE-068, wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Hsieh, H.-M., 76082202, culms of ***Phyllostachys pubescens var. pubescens*** (JDR); Nan-tou Co., Lu-ku, Sun-linn-shi, 20.XI.1983, Ju, Y.-M., PPE-065, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 13.IX.1984, Ju, Y.-M., PPE-083, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VIII.1988, Ju, Y.-M., 77082309 (CULTURED), wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072327, wood (JDR); Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072324 (CULTURED), wood (JDR); Taipei Co., Wu-lai, 11.VII.1985, Ju, Y.-M., PPE-103, wood (JDR).

NOTES: This fungus is a member of the ***X. polymorpha*** complex. Its teleomorph has been reported by Ju and Tzean (1985b) in Taiwan.

Xylaria scruposa (Fr.: Fr.) Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 127. 1851. Fig. 63

The teleomorph is as described by Rogers and Callan (1986). The colony morphology largely agrees with the description in Rogers et al. (1987, 1988).

Anamorph observed on SMEA. No definite stromata produced. Conidium-bearing hyphal tufts at periphery of colony. Conidiophores upright, loosely arranged, mostly dichotomously branched several times from base, pale olivaceous brown, smooth. Conidiogenous cells terminal, clavate-cylindrical, 10-20 x 3-4.5 µm, hyaline, smooth, bearing lateral and terminal denticulate conidial secession scars ca. 0.5 µm high x 0.5-1 µm broad at base. Conidia produced holoblastically in sympodial sequence. Conidia hyaline to subhyaline, smooth, ellipsoid, 7-10(-11) x (3-)3.5-4 µm, with flattened base ca. 1 µm broad indicating former point of attachment to conidiogenous cell.

SPECIMENS EXAMINED: Nan-tou Co., Lu-ku, Shi-tou, 6.XI.1988, Ju, Y.-M., 77110601 (CULTURED), wood (JDR); Nan-tou Co., Lu-ku, Shi-tou, 22.VIII.1987, Ju, Y.-M., 76082230, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082025, wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080711 (CULTURED), wood (JDR); Nan-tou Co., Yu-chee, Lien-hwa-chee, 7.VIII.1988, Ju, Y.-M., 77080702 (CULTURED), wood (JDR).

NOTES: The conidiophores of ***X. scruposa***, unlike ***X. polymorpha***, ***X. schweinitzii***, and ***X. anisopleura***, are loosely arranged on the colony surface. It is surprising to find this type of conidiophore in the ***X. polymorpha*** complex, whose conidiophores usually form dense palisades on well-formed stromata. However, ***Xylaria scruposa*** is a complex species with unclear limits. No type material has been located and it has not been neotypified. More studies must be accomplished before conclusions on relationships can be definitely established.

Xylaria *sp.* (76072304)

Teleomorph is as described by San Martín and Rogers (1989) [as ***Xylaria*** *sp.* SM 337].

Colonies sometimes covering Petri dish in 4 wk, usually not reaching the edge of Petri dish, at first whitish, velvety, azonate, with diffuse, fimbriate margins, becoming overlain with a dark gray layer of hyphae. Reverse uncolored. Stromata acicular or infrequently narrowly feather-like, ca. 0.3 mm diam, branched or unbranched, initially whitish, becoming overlain with black hyphae from base upwards, ornamented with stiff hyphae. Anamorph not produced in culture.

SPECIMEN EXAMINED: Ping-tung Co., Heng-chun, Ken-ting, 23.VII.1987, Ju, Y.-M., 76072304 (CULTURED), fallen leaves (JDR).

NOTES: This fungus greatly resembles descriptions of ***X. sicula*** Pass. & Beltr. *f. **major*** Ciccarone. No conidial state was found in culture from this leaf-inhabiting fungus.

***Xylaria** sp.* (77080301) Figs. 27, 28, 47

Stromata unbranched, ellipsoid-clavate to broadly ellipsoid-clavate, with rounded fertile apices, on short stipes, 0.6-2 cm total length x 0.4-1.5 cm diam; surface blackish, smooth, with thin, brown outermost layer finely cracked into polygonal plaques; carbonaceous immediately beneath surface; whitish, hard between and beneath perithecia; interior becoming hollow. Perithecia spherical, 0.7-0.9 mm diam. Ostioles hemispherical. Asci eight-spored, cylindrical, stipitate, (275-)300-330 μm total length x 9-10 μm broad, the spore-bearing part 100-135 μm long, with apical ring bluing in Melzer's iodine reagent, urn-shaped, 5-6.2 μm high x 3.8-4.3 μm broad. Ascospores dark brown, blackened toward both ends, unicellular, fusoid-inequilateral, with narrowly rounded ends each bearing a minute hyaline noncellular appendage, (26-)28-32(-35) x 7-9 μm, with straight germ slit almost spore-length.

Colonies covering Petri dish in 4 wk, at first whitish, velvety to felty, zonate, with radiating furrows and fimbriate margins, then becoming olivaceous black. Reverse uncolored. Stromata not formed. Sporulating regions on surface of colonies. Conidiophores upright, di- or trichotomously branched, pale olivaceous brown, smooth, 2-3 μm broad, usually with helical hyphae produced at base. Conidiogenous cells terminal, clavate, 7-20 x 2.5-3.5 μm, hyaline, smooth, bearing lateral and terminal flattened discoid conidial secession scars ca. 0.3 μm high x 1 μm broad. Conidia produced holoblastically in sympodial sequence. Conidia hyaline, smooth, ellipsoid, 6.5-8 x 2.5-3.2 μm, with narrowly rounded apices and flattened base ca. 1.3 μm broad indicating former point of attachment to conidiogenous cell. Some conidia with flattened apices or small, corona-like apical processes.

SPECIMENS EXAMINED: Nan-tou Co., Mei-fong, 8.X.1982, collector unknown, 71100801, wood (JDR); Tao-yuan Co., Fu-hsin, La-la-shan, 3.VIII.1988, Ho, S.-M., 77080301 (CULTURED), wood (JDR).

NOTES: This fungus is similar to ***X. obovata*** in stromatal morphology and ascospore size. Nonetheless, the fusoid-inequilateral, rather than ellipsoid-inequilateral, ascospores with a long, almost spore-length germ slit make this taxon separable from ***X. obovata***. Its smaller conidia also reinforce this contrast. In culture, no stromata have been seen; conidium-bearing structures were found only on aerial hyphae.

***Xylaria** sp.* (80082005) Fig. 43

Stromata unbranched, scattered, cylindrical, usually with acute sterile apices, on smooth stipes, 11-14 mm total length x 1 mm diam, the fertile part 4.5-5 mm long; surface blackish, smooth, with conspicuous perithecial mounds, overlain with dark outer peeling layer; carbonaceous immediately beneath surface; whitish, hard between and beneath perithecia. Perithecia spherical, 0.4-0.5 mm diam. Ostioles papillate. Asci eight-spored, cylindrical, stipitate, 140-170 μm total length x 7-9 μm broad, the spore-bearing part 80-90 μm long, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped, 3 μm high x 2.5 μm broad. Ascospores brown to dark brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends usually bearing a tiny hyaline cellular appendage on one end, surrounded with a hyaline, slimy sheath evident at both ends, 13.5-16.5 x 5-6 μm, with straight germ slit spore-length on the flattened side.

SPECIMEN EXAMINED: Nan-tou Co., Yu-chee, Lien-hwa-chee, 20.VIII.1991, Ju, Y.-M., 80082005 (CULTURED), fallen leaves (JDR).

NOTES: This slender leaf-inhabiting fungus is characterized by the striped peeling layer on the surface, the cristate apices, and the possession of a cellular and two non-cellular appendages on the ascospore. ***Xylaria phyllophila*** Ces., originally described from Borneo, Malaysia, may be a tenable name for this fungus. Unfortunately, the type was not located at RO. Cooke's (1883) sketches of a stroma and ascospores of ***X. phyllophila*** resemble those of our fungus.

***Xylaria** sp.* (77010712) Figs. 6, 7, 33

Stromata usually densely aggregated, pulvinate, bearing one to several perithecia, 1.5-2.5 mm diam x 1-1.5 mm high, with convex top, on narrow or wide central connective; surface dark brown, with conspicuous perithecial mounds, smooth; carbonaceous immediately beneath surface; white, coriaceous between and beneath perithecia. Perithecia spherical, 0.6-0.8 mm diam. Ostioles conic-papillate. Asci eight-spored, cylindrical, 240-270 μm total length x 9-10.5 μm broad, the spore-bearing part 105-120 μm long, with apical ring bluing in Melzer's iodine reagent, cuneate to oblong inverted hat-shaped, 4-4.5 μm high x 4 μm broad. Ascospores brown, unicellular, broadly ellipsoid, nearly equilateral, with broadly rounded ends, (12-)13-15(-17) x 7.5-8.5(-9) μm, with long spiral germ slit.

Colonies covering Petri dish 6-7 wk, white, floccose, faintly zonate or azonate, with lobed margins. Reverse tan. Anamorph not produced.

SPECIMEN EXAMINED: Nan-tou Co., Hsin-yi, Pa-tong-gwang, 7.I.1988, Ju, Y.-M., 77010712 (CULTURED), wood (JDR).

ADDITIONAL SEPCIMEN EXAMINED: CHINA: Kweichow Prov., Chiang-kou Co., Heh-wan, 11.X.1931, Cheo, S.Y. 851, decorticated rotten stems (JDR).

NOTES: This small collection probably represents an undescribed taxon. The long spiral ascospore germ slit is noteworthy. This fungus could have affinities with ***Rosellinia*** subgenus ***Corrugata*** L. E. Petrini (Petrini, 1993). Some taxa, e.g., ***R. diathrausta*** (Rehm) L. E. Petrini [≡ ***Hypoxylon diathraustum*** Rehm], in that subgenus are fairly atypical of ***Rosellinia*** and might eventually be placed elsewhere. A specimen from China, Cheo 851, is apparently closely related to the Taiwan collection but has narrower ascospores, 12.5-14 x 5.5-6.5 μm.

Xylaria striata Pat., J. Bot. (Morot) 1: 247. 1887.

Stromata unbranched or dichotomously branched, long cylindrical, with acute sterile apices, on short to long smooth stipes, 7-10(-14) cm total length x 2-3 mm diam; surface dark brown to blackish, smooth, with conspicuous perithecial mounds, overlain with brown striped peeling layer; carbonaceous immediately beneath surface; whitish, hard between and beneath perithecia. Perithecia spherical, 0.6-0.8 mm. Ostioles papillate. Asci deliquescent, with apical ring bluing in Melzer's iodine reagent, urn-shaped, 4-5 µm high x 3-3.5 µm broad. Ascospores light brown, unicellular, fusoid-inequilateral, usually with abruptly narrowed ends, 15-18(-20) x 4.8-5.5 µm, with straight germ slit much less than spore-length.

SPECIMEN EXAMINED: Hwa-lien Co., Fen-ling, IX.1984, Jang, J.-C., PPE-087, dead wood of ***Leucaena glauca*** (JDR).

ADDITIONAL SPECIMENS EXAMINED: BRAZIL: Rio Grande do Sul, São Leopoldo, no date, Rick, J. (S, TYPE of ***Xylaria rickii***). CHINA: Yunnan, Langkong, Mosoyu, II, 1887, Telavay 2301, monocot (SYNTYPE of ***Xylaria striata***), immature; Yunnan, Langkong, Mosoyu, Telavay, monocot (SYNTYPE of ***Xylaria striata***).

NOTES: This fungus was originally reported on ***Trachycarpus sp.***, a monocot, from China (see Saccardo, 1891). The present collection fits well the type of ***X. striata*** except that it was collected from dicot wood. No cultures were obtained from this material. Ju and Tzean (1985b) identified it as ***X. rickii*** Theiss. Type material of ***X. rickii*** at S has a short and broad germ slit on the convex side of the ascospore. Its stromatal surface apparently lacks a striped peeling layer.

Xylaria telfairii (Berk.) Fr., Nova Acta Regiae Soc. Sci. Upsal., ser. III, 1: 127. 1851.

See Ju and Tzean (1985b) and Callan and Rogers (1990) for descriptions of the teleomorph. The cultures are as described by Callan and Rogers (1990).

SPECIMENS EXAMINED: Hsin-chu Co., Wu-tsee-shan, 25.IX.1982, collector unknown, 71092501, wood (JDR); I-lan Co., Ta-yuan-shan, 15.V.1986, Ju, Y.-M., PPE-117, wood (JDR); Taipei Co., Wu-lai, 10.VII.1985, Ju, Y.-M., PPE-097, wood (JDR); Tao-yuan Co., Fu-hsin, La-la-shan, 3.VIII.1988, Ho, S.-M., 77080307 (CULTURED), wood (JDR).

NOTES: The cultures are much as described by Callan and Rogers (1990). Unfortunately, no anamorph was produced from them.

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LITERATURE CITED

Abe, Y. 1986a. Notes on some common xylariaceous and diatrypaceous fungi on hardwoods in Japan I. Bull. Forest. & Forest Products Res. Inst. 339: 1-26.

Abe, Y. 1986b. Notes on some common xylariaceous and diatrypaceous fungi on hardwoods on Japan II. ***Hypoxylon hypomiltum*** and its small-spored variety. Trans. Mycol. Soc. Japan 27: 51-56.

Abe, Y., and Z. Liu. 1995. An annotated list of xylariaceous and diatrypaceous fungi collected from Mt. Fengyangshan and Mt. Baishanzu, Zhejiang Prov. in East China. Bull. Nat. Sci. Mus. Tokyo, Ser. B, 21: 75-86.

Callan, B. E., and J. D. Rogers. 1990. Teleomorph-anamorph connections and correlations in some ***Xylaria*** species. Mycotaxon 36: 343-369.

Callan, B. E., and J. D. Rogers. 1993. A synoptic key to ***Xylaria*** species from continental United States and Canada based on cultural and anamorphic features. Mycotaxon 46: 141-154.

Cannon, P. F., and A. J. S. Whalley. 1988. Notes on an unusual ***Xylaria*** growing in a British hothouse. Trans. Brit. Mycol. Soc. 91: 176-179.

Carroll, G. 1963. Studies in the flora of Thailand 24. Pyrenomycetes. Dansk Bot. Ark. 23: 101-114.

Chen, Z.-C. 1975. Notes on new Formosan forest fungi II. Some lignicolous fungi. Taiwania 20: 201-212.

Chen, Z.-C. 1987. Distribution of Agaricales in Taiwan. Trans. Mycol. Soc. Republ. of China 2: 1-21.

Child, M. 1932. The genus ***Daldinia***. Ann. Missouri Bot. Gard. 19: 429-496.

Cooke, M. C. 1883. On ***Xylaria*** and its allies. Grevillea 11: 81-94.

Dennis, R. W. G. 1956. Some Xylarias of tropical America. Kew Bull. 1956: 401-444.

Dennis, R. W. G. 1957. Further notes on tropical American Xylariaceae. Kew Bull. 1957: 297-332.

Dennis, R. W. G. 1958. Some Xylosphaeras of tropical Africa. Revista Biol., Lisboa 1: 175-208.

Dennis, R. W. G. 1974. Xylariaceae from Papua and New Guinea. Bull. Mens. Soc. Linn. Lyon, Num. Spéc. 43: 127-138.

Fang, J. G., C. S. Lee, and W. H. Hsieh. 1986. The perfect state of root and basal stem rot of sugarcane. Rep. Taiwan Sugar Exp. Sta. 111: 9-13.

Francis, S. M. 1985. ***Rosellinia necatrix*** - fact or fiction? Sydowia 38: 75-86.

Greenhalgh, G. N., and C. G. C. Chesters. 1968. Conidiophore morphology in some British members of the Xylariaceae. Trans. Brit. Mycol. Soc. 51: 57-82.

Hawksworth, D. L. 1977. ***Rhopalostroma***, a new genus in the Xylariaceae s.l. Kew Bull. 31: 421-431.

Hennings, P. 1893. Fungi Warburgiani. Hedwigia 32: 216-227.

Hennings, P. 1908. Fungi Philippinenses I. Hedwigia 47: 250-265.

Hino, I., and K. Katumoto. 1961. Icones fungorum bambusicolorum Japonicorum. Fuji Bamboo Garden. 335 p.

Hsieh, W. H. 1980. Root and basal stem rots of sugarcane: a new disease caused by ***Xylaria*** *sp*. Rep. Taiwan Sugar Exp. Sta. 87: 15-24.

Joly, P. 1968. Éléments de la flore mycologique du Viet-Nam (Troisième contribution: A propos de quelques Xylarias). Rev. Mycol. (Paris) 33: 155-207.

Jong, S. C., and J. D. Rogers. 1970. ***Penzigia frustulosa*** in culture. Mycologia 62: 851-855.

Jong, S. C., and J. D. Rogers. 1972. Illustrations and descriptions of conidial states of some ***Hypoxylon*** species. Wash. State Agric. Exp. Sta. Bull. 71. 51 p.

Ju, Y.-M., and J. D. Rogers. 1990. ***Astrocystis*** reconsidered. Mycologia 82: 342-349.

Ju, Y.-M., and J. D. Rogers. 1994. ***Kretzschmariella culmorum*** (Cooke) *comb. nov.* and notes on some monocot-inhabiting xylariaceous fungi. Mycotaxon 51: 241-255.

Ju, Y.-M., and J. D. Rogers. 1996. A revision of the genus ***Hypoxylon***. American Phytopathological Society Press, St. Paul, Minnesota. 365 p.

Ju, Y.-M., J. D. Rogers, and F. San Martín González. 1997. A revision of the genus ***Daldinia***. Mycotaxon 61: 243-293.

Ju, Y.-M., J. D. Rogers, F. San Martín González, and A. Granmo. 1998. The genus ***Biscogniauxia***. Mycotaxon 66: 1-98.

Ju, Y.-M., F. San Martín González, and J. D. Rogers. 1993. Three xylariaceous fungi with scolecosporous conidia. Mycotaxon 47: 219-228.

Ju, Y.-M., and S.-S. Tzean. 1985a. Investigation of Xylariaceae in Taiwan I. The teleomorph of ***Hypoxylon***. Trans. Mycol. Soc. Republ. of China 1: 13-27.

Ju, Y.-M., and S.-S. Tzean. 1985b. Investigation of Xylariaceae in Taiwan II. The teleomorph of ***Xylaria***. Trans. Mycol. Soc. Republ. of China 1: 103-128.

Kamat, M. N., and A. Pande. 1975. Contributions to the Xylariaceae of Western India. I. Science J. Shivaji Univ. 15: 71-73.

Katumoto, K. 1978. Notes on some ***Hypoxylon*** species from Japan (1). Bull. Fac. Agric. Yamaguti Univ. 29: 47-64.

Kenerley, C. M., and J. D. Rogers. 1976. On ***Hypoxylon serpens*** in culture. Mycologia 68: 688-691.

Laessøe, T., and B. M. Spooner. 1994. ***Rosellinia*** & ***Astrocystis*** (Xylariaceae): New species and generic concepts. Kew Bull. 49: 1-70.

Lloyd, C. G. 1919. Mycological notes No. 61. Mycol. Writings 6: 877-903.

Lloyd, C. G. 1920. Mycological notes No. 62. Mycol. Writings 6: 904-944.

Lloyd, C. G. 1921. Mycological notes No. 65. Mycol. Writings 6: 1029-1101.

Martin, P. 1970. Studies in the Xylariaceae: VIII. ***Xylaria*** and its allies. J. S. African Bot. 36: 71-83.

Miller, J. H. 1961. A monograph of the world species of ***Hypoxylon***. Univ. Georgia Press, Athens. 158 p.

Müller, M. J. 1982. Selected climatic data for a global set of standard stations for vegetation science. Dr. W. Junk Publishers. 306 p.

Penzig, O., and P. A. Saccardo. 1904. Icones fungorum Javanicorum. E. J. Brill, Leiden. 124 p + illus.

Petrini, L. E. 1993. ***Rosellinia*** species of the temperate zones. Sydowia 44: 169-281.

Petrini, L. E., and E. Müller. 1986. Haupt- und nebenfruchtformen europäischer ***Hypoxylon***- Arten (Xylariaceae, Sphaeriales) und verwandter pilze. Mycologia Helv. 1: 501-627.

Petrini, L. E., and O. Petrini. 1985. Xylariaceous fungi as endophytes. Sydowia 38: 216-234.

Petrini, L. E., O. Petrini, and S. M. Francis. 1989. On ***Rosellinia mammaeformis*** and other related species. Sydowia 41: 257-276.

Petrini, L. E., and J. D. Rogers. 1986. A summary of the ***Hypoxylon serpens*** complex. Mycotaxon 26: 401-436.

Pouzar, Z. 1985. Reassessment of ***Hypoxylon serpens*** - complex I. Česká Mykol. 39: 15-25.

Rappaz, F. 1995. ***Anthostomella*** and related xylariaceous fungi on hard wood from Europe and North America. Mycologia. Helv. 7: 99–168.

Rayner, R. W. 1970. A mycological colour chart. Commonwealth Mycological Institute, Kew and British Mycological Society. 34 p. + charts I & II.

Rehm, H. 1913a. Ascomycetes Philippinenses collecti a clar. C. F. Baker. Philipp. J. Sci. 8: 181-194.

Rehm, H. 1913b. Ascomycetes Philippinenses, II. Philipp. J. Sci. 8: 251-263.

Rehm, H. 1913c. Ascomycetes Philippinenses, III. Philipp. J. Sci. 8: 391-405.

Rehm, H. 1913d. Ascomycetes Philippinenses-IV. Communicati a clar. C. F. Baker. Leafl. Philipp. Bot. 6: 1935-1947.

Rehm, H. 1914a. Ascomycetes Philippinenses-V. Communicati a clar. C. F. Baker. Leafl. Philipp. Bot. 6: 2191-2237.

Rehm, H. 1914b. Ascomycetes Philippinenses-VI. Communicati a clar. C. F. Baker. Leafl. Philipp. Bot. 6: 2257-2281.

Rehm, H. 1915. Ascomycetes Philippinenses-VII. Communicati a clar. C. F. Baker. Leafl. Philipp. Bot. 8: 2921-2933.

Rehm, H. 1916. Ascomycetes Philippinenses-VIII. Communicati a clar. C. F. Baker. Leafl. Philipp. Bot. 8: 2935-2961.

Rogers, J. D. 1979. The Xylariaceae: systematic, biological and evolutionary aspects. Mycologia 71: 1-42.

Rogers, J. D. 1984. ***Xylaria cubensis*** and its anamorph ***Xylocoremium flabelliforme***, ***Xylaria allantoidea***, and ***Xylaria poitei*** in continental United States. Mycologia 76: 912-923.

Rogers, J. D. 1985. ***Hypoxylon duranii sp. nov.*** and the anamorphs of ***H. caries***, ***H. papillatum***, and ***Rosellinia subiculata***. Mycotaxon 23: 429-437.

Rogers, J. D., and B. E. Callan. 1986. ***Xylaria polymorpha*** and its allies in continental United States. Mycologia 78: 391-400.

Rogers, J. D., B. E. Callan, A. Y. Rossman, and G. J. Samuels. 1988. ***Xylaria*** (Sphaeriales, Xylariaceae) from Cerro de la Neblina, Venezuela. Mycotaxon 31: 103-153.

Rogers, J. D., B. E. Callan, & G. J. Samuels. 1987. The Xylariaceae of the rain forests of North Sulawesi (Indonesia). Mycotaxon 29: 113-172.

Rogers, J. D., and F. Candoussau. 1980. A new variety of ***Hypoxylon cohaerens*** from France. Mycologia 72: 826-829.

Rogers, J. D., and Y.-M. Ju. 1997. The genus ***Stilbohypoxylon***. Mycol. Res. 101: 135-138.

Rogers, J. D., and Y.-M. Ju. 1998. The genus ***Kretzschmaria***. Mycotaxon 68: 345-393.

Rogers, J. D., Y.-M. Ju, and D. E. Hemmes. 1997. ***Xylaria moelleroclavus*** *sp. nov.* and its ***Moelleroclavus*** anamorphic state. Mycol. Res. 101: 345-348.

Rogers, J. D., Y.-M. Ju, and F. San Martín. 1997. ***Jumillera*** and ***Whalleya***, new genera segregated from ***Biscogniauxia***. Mycotaxon 64: 39-50.

Rogers, J. D., Y.-M. Ju, R. Watling, and A. J. S. Whalley. 1999. A reinterpretation of ***Daldinia concentrica*** based upon a recently discovered specimen. Mycotaxon 72: 507-519.

Rogers, J. D., and G. J. Samuels. 1986. Ascomycetes of New Zealand 8. ***Xylaria***. New Zealand J. Bot. 24: 615-650.

Saccardo, P. A. 1882. Sylloge fungorum omnium hucusque cognitorum. I. Patavii. 768 p.

Saccardo, P. A. 1891. Sylloge fungorum omnium hucusque cognitorum. IX. Patavii. 1141 p.

Saccas, A. M. 1956. Les ***Rosellinia*** des caféiers en oubangui-chari. Agron. Trop. (Nogent-sur-Marre) 11: 551-614.

Samuels, G. J., J. D. Rogers, and E. Nagasawa. 1987. Studies in the Amphisphaeriaceae (sensu lato). 1. ***Collodiscula japonica*** and its anamorph, ***Acanthodochium collodisculae***. Mycotaxon 28: 453-459.

San Martín González, F., and J. D. Rogers. 1989. A preliminary account of ***Xylaria*** of Mexico. Mycotaxon 34: 283-373.

San Martín González, F., and J. D. Rogers. 1995. ***Rosellinia*** and ***Thamnomyces*** in Mexico. Mycotaxon 53: 115-127.

Sawada, K. 1928. Descriptive catalogue of the Formosan fungi. IV. Bull. Dept. Agric. Gov. Res. Inst. Formosa 35: 1-123.

Sawada, K. 1931. Descriptive catalogue of the Formosan fungi. V. Bull. Dept. Agric. Gov. Res. Inst. Formosa 51: 1-131.

Sawada, K. 1933. Descriptive catalogue of the Formosan fungi. VI. Bull. Dept. Agric. Gov. Res. Inst. Formosa 61: 1-99.

Sawada, K. 1959. Descriptive catalogue of the Formosan fungi. XI. Coll. Agric. Natl. Taiwan Univ., Spec. Publ. 8: 1-268.

Schatz, S. 1988. ***Hypoxylon oceanicum*** *sp. nov.* from mangroves. Mycotaxon 33: 413-418.

Schumacher, T. 1982. Ascomycetes from Northern Thailand. Nord. J. Bot. 2: 257-263.

Shear, C. L. 1941. Mycological notes. V. Mycologia 33: 318-332.

Sydow, H., and P. Sydow. 1913. Enumeration of Philippine fungi, with notes and description of new species. Part I: Micromycetes. Philipp. J. Sci. 8: 265-285.

Sydow, H., and P. Sydow. 1917. Beitrag zur kenntnis der pilzflora der Philippinen-Insel. Ann. Mycol. 15: 165-268.

Tai, F. L. 1979. Sylloge fungorum Sinicorum. Science Press, Peking. 1527 p.

Teng, S. C. 1935. Supplementary notes on Ascomycetes from China. Sinensia 6: 185-218.

Van der Gucht, K. 1995. Illustrations and descriptions of xylariaceous fungi collected in Papua New Guinea. Bull. Jard. Bot. Nat. Belg. 64: 219-403.

Van der Gucht, K. 1996. ***Xylaria*** species from Papua New Guinea: cultural and anamorphic studies. Mycotaxon 60: 327-360.

Van der Gucht, K., Y.-M. Ju, and J. D. Rogers. 1997. New ***Hypoxylon*** species from Papua New Guinea and notes on some other taxa. Mycologia 89: 503-511.

Van der Gucht, K., and A. J. S. Whalley. 1992. A new variety and combination for ***Hypoxylon citriforme***. Mycol. Res. 96: 895-896.

Whalley, A. J. S., E. B. G. Jones, and S. A. Alias. 1994. The Xylariaceae (Ascomycetes) of mangroves in Malaysia and South East Asia. Nova Hedwigia 59: 207-218.

FIGURE LEGENDS

Figs. 1-10. ***Hypoxylon ilanense***, ***Nemania memorabilis***, ***N. minutula***, ***Xylaria*** *sp.*, and ***Rhopalostroma luzonense***. 1, 2. ***H. ilanense*** (holotype). 1. Stroma; X6. 2. Stromatal surface; X16. 3, 4. ***N. memorabilis*** (76082227). 3. Stromata; X1.75. 4. Stromatal surface; X16. 5. ***N. minutula*** (77031506). Stromata; X5. 6, 7. ***Xylaria*** *sp.* (77010712). Stromata; X10. 8-10. ***R. luzonense*** (80091110). 8. Stromata; X2.5. 9. Stromata; X6. 10. Vertical section of stroma; X6.

Figs. 11-21. ***Rosellinia formosana***, ***R. lamprostoma***, ***Xylaria areolata***, ***X. bambusicola***, and ***X. cubensis***. 11, 12. ***R. formosana*** (holotype). 11. Stromata; X1.75. 12. Stroma; X25. 13. ***R. lamprostoma*** (80091007). Stromata; X6. 14-16. ***X. areolata*** (80082008). 14. Stromata; X1. 15. Stromatal surface; X6. 16. Vertical section of stroma; X6. 17, 18. ***X. bambusicola*** (holotype). 17. Stromata; X1. 18. Stromatal surface; X16. 19-21. ***X. cubensis***, hypoxyloid form (85101102). 19. Stromata; X3. 20. Stromatal surface; X16. 21. Vertical section of stroma; X16.

Figs. 22-28. ***Xylaria glebulosa***, ***X. schwackei***, and ***X.*** *sp.* 22, 23. ***X. glebulosa*** (77082307). 22. Stromata; X1.25. 23. Stroma; X16. 24-26. ***X. schwackei*** (77072401). 24, 25. Stromata; X3. 26. Stromatal surface; X16. 27, 28. ***X.*** *sp.* (77080301)(from 71100801). 27. Stromata; X2.5. 28. Stromatal surface, the arrowheads pointing to ostioles; X16.

Figs. 29-45. Ascospores and ascus tips. 29. ***Biscogniauxia*** *sp.* (80091405). 30. ***Hypoxylon ilanense*** (holotype). 31. ***Nemania memorabilis*** (76072227). 32. ***N.*** *sp.* (80082010). 33. ***Xylaria*** *sp.* (77010712). 34. ***Rosellinia griseocincta*** (77082325). 35. ***R. lamprostoma*** (80091007). 36. ***R. merrillii*** (77082401). 37. ***N.*** *sp.* (76100601). 38. ***Stilbohypoxylon*** *sp.* (75021102). 39. ***S.*** *sp.* (77062107). 40. ***X. areolata*** (80082008). 41. ***X. bambusicola*** (holotype). 42. ***X. glebulosa*** (77082307). 43. ***X.*** *sp.* (80082005). 44. ***X. schwackei*** (77072401). 45. ***R. formosana*** (holotype). The scale bar represents 10 μm.

Fig. 46. ***Hypoxylon*** *sp.* (77082404). Conidiophores and conidia. The scale bar represents 10 μm.

Fig. 47. ***Xylaria*** *sp.* (77080301). Conidiophores and conidia. The scale bar represents 10 μm.

Fig. 48. ***Nemania bipapillata*** (77071401). Conidiophores, conidia, and heavily encrusted hypha. The scale bar represents 10 μm.

Fig. 49. ***Rosellinia griseocincta*** (77082325). Conidiophores and conidia. The scale bar represents 10 μm.

Fig. 50. ***Rosellinia merrillii*** (77082401). Conidiophores and conidia. The scale bar represents 10 μm.

Fig. 51. ***Rosellinia necatrix*** (76082249). Conidiophores and conidia. The scale bar represents 10 μm. The scale bar represents 10 μm.

Figs. 52, 53. Conidiophores and conidia. 52. ***Halorosellinia oceanica*** (77111601). 53. ***Stilbohypoxylon*** *sp.* (77062107). The scale bar represents 10 μm.

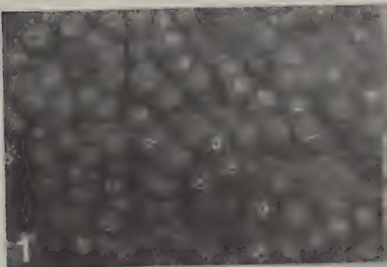
Figs. 54, 55. Conidiophores and conidia. 54. ***Xylaria allantoidea*** (77102501). 55. ***X. atrosphaerica*** (76082224). The scale bar represents 10 μm.

Figs. 56, 57. Conidiophores and conidia. 56. ***Xylaria curta*** (76121001). 57. ***X. consociata*** (77082306). The scale bar represents 10 μm.

Figs. 58-60. Conidiophores and conidia. 58. ***Xylaria ianthinovelutina*** (76082210). 59. ***X. schwackei*** (77072401). 60. ***X. glebulosa*** (77082307). The scale bar represents 10 μm.

Figs. 61, 62. Conidiophores and conidia. 61. ***Xylaria laevis*** (77112201). 62. ***X. papulis*** (77082303). The scale bar represents 10 μm.

Fig. 63. ***Xylaria scruposa*** (77080702). Conidiophores and conidia. The scale bar represents 10 μm.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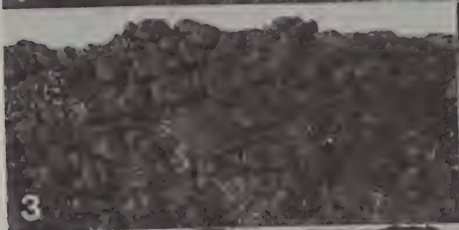
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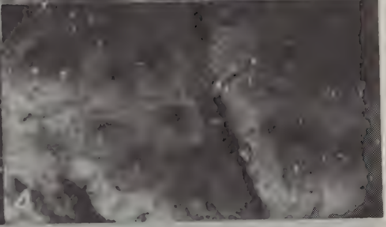
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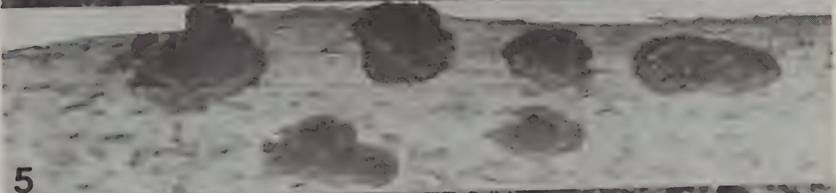
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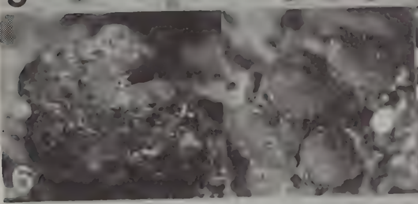
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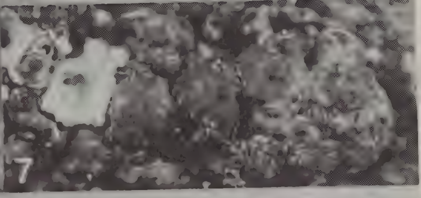
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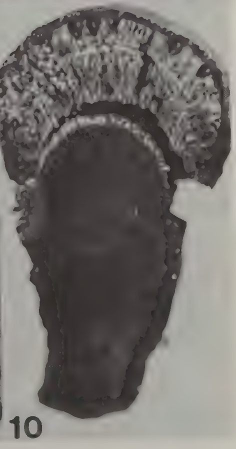
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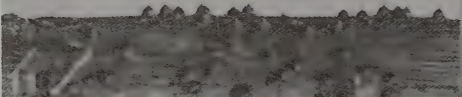
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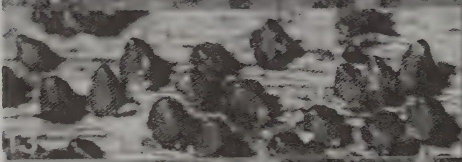
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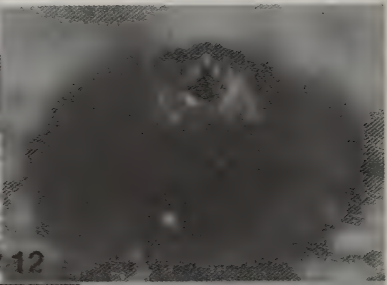
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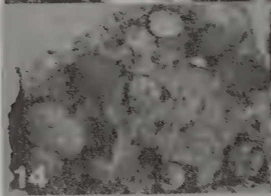
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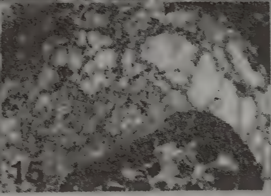
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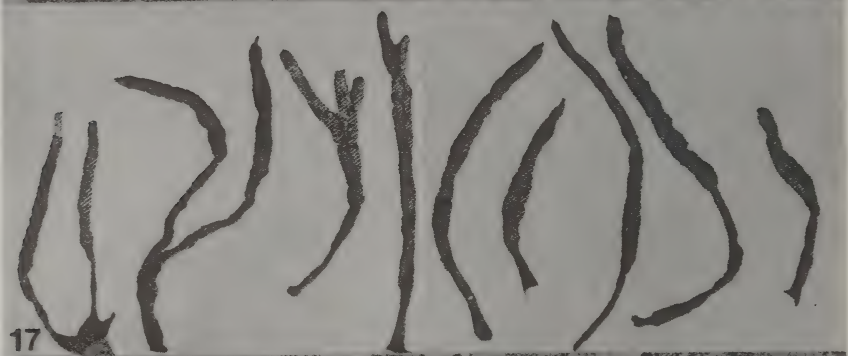
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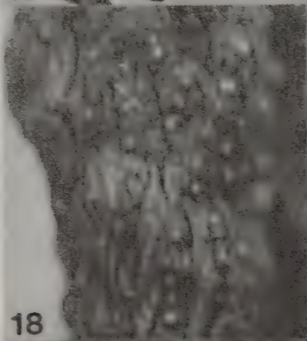
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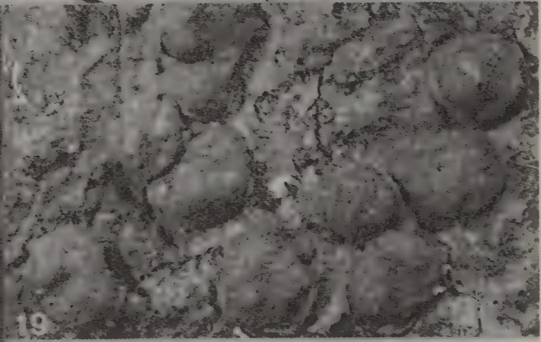
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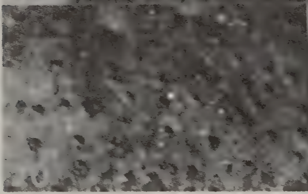
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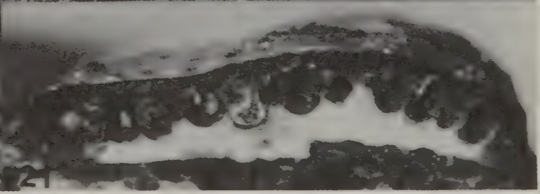
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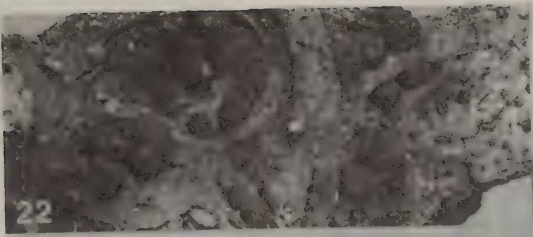
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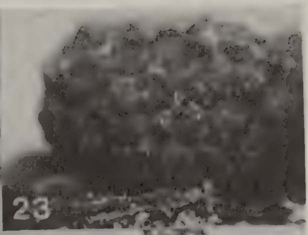
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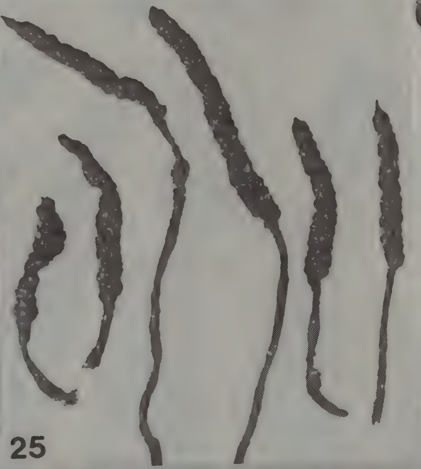
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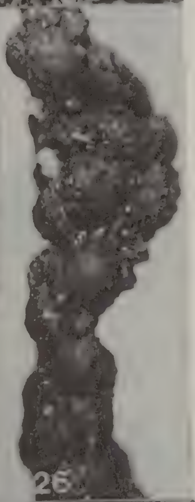
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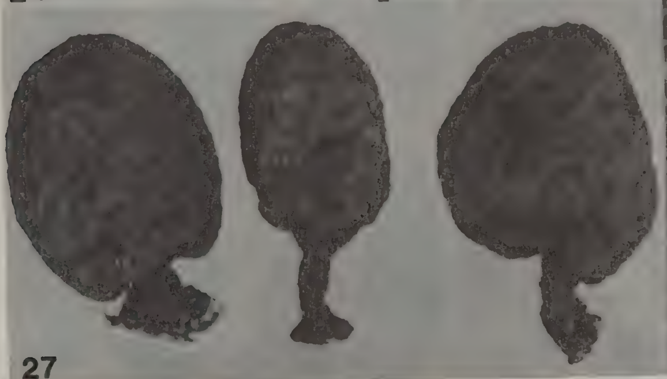
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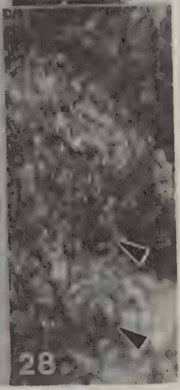
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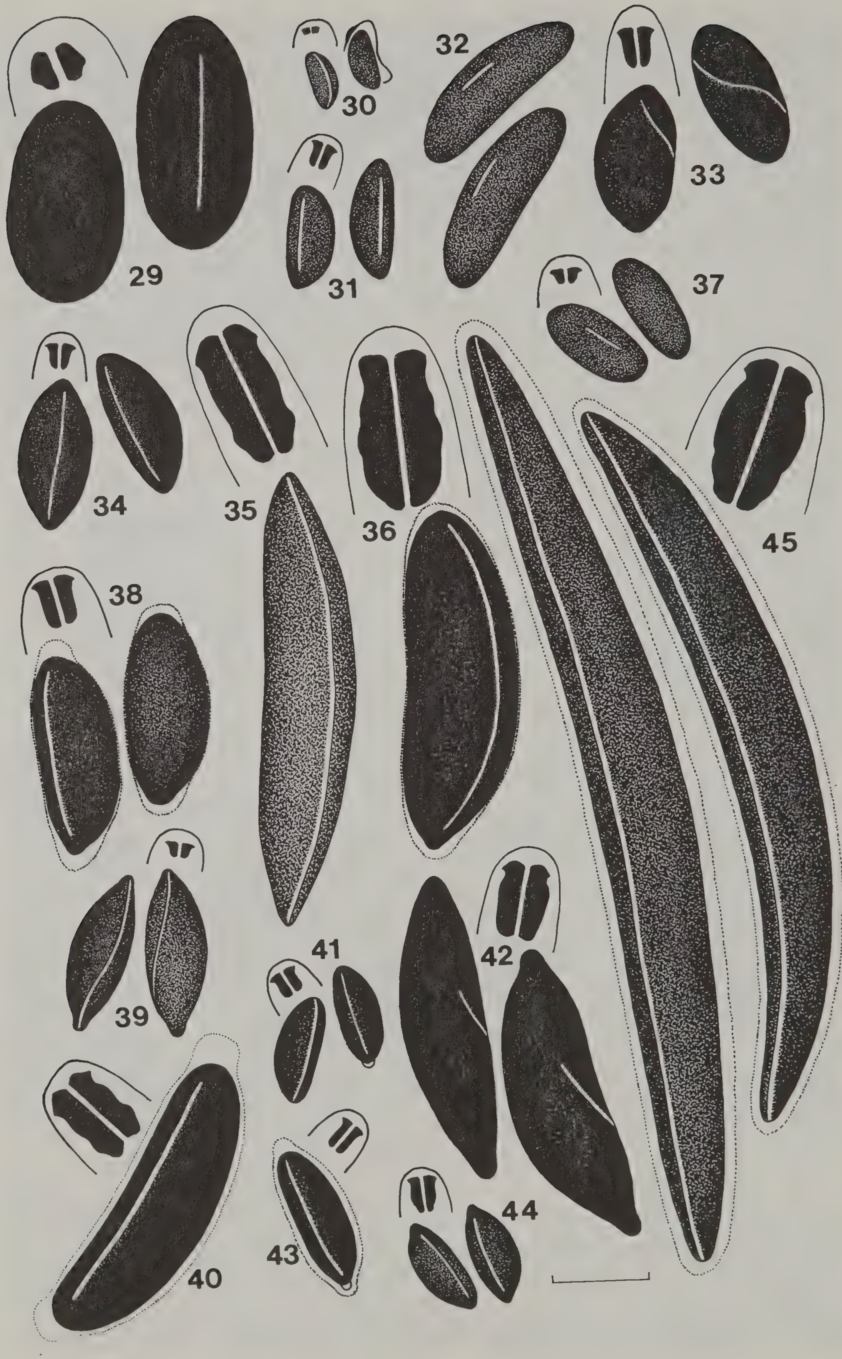

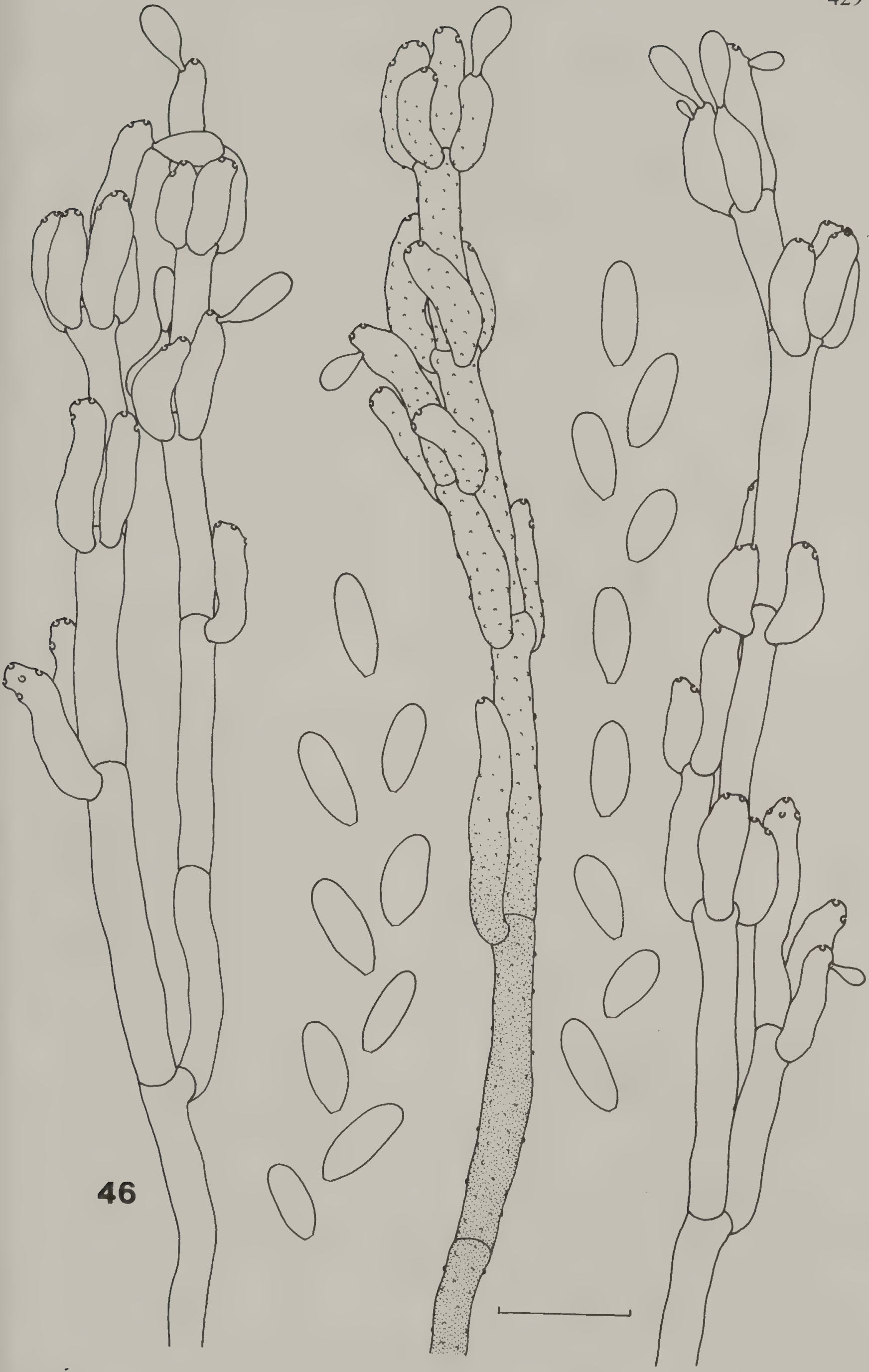

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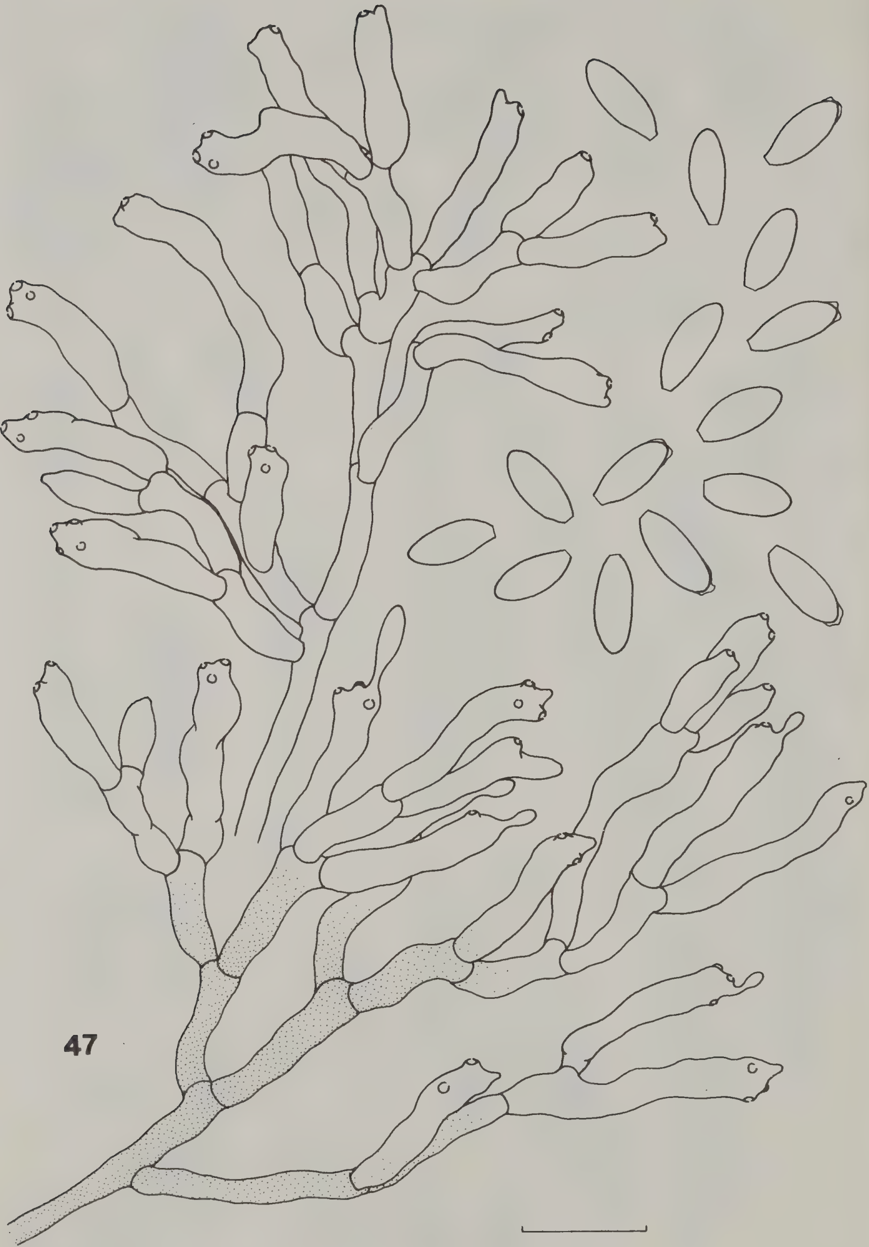

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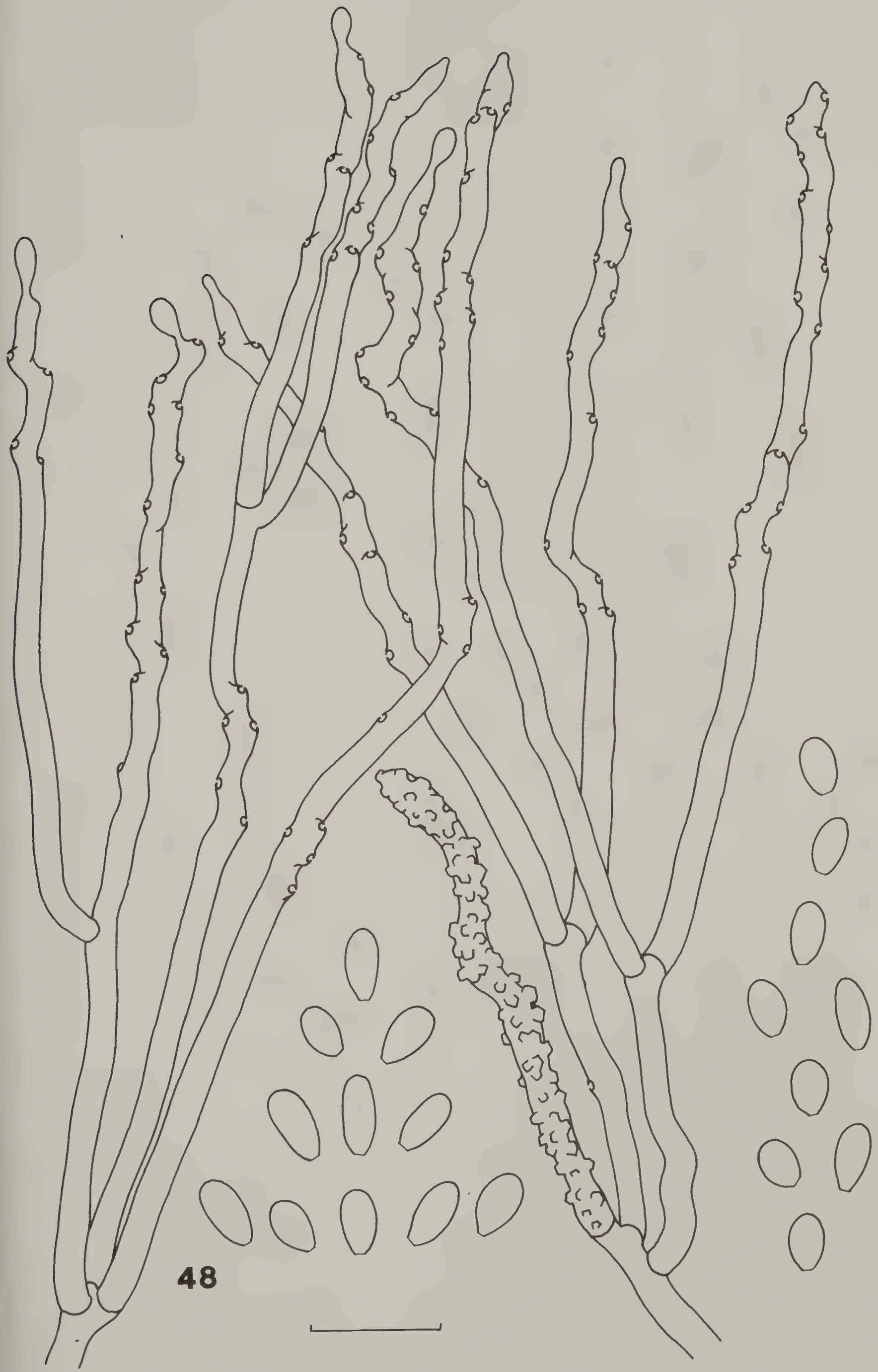

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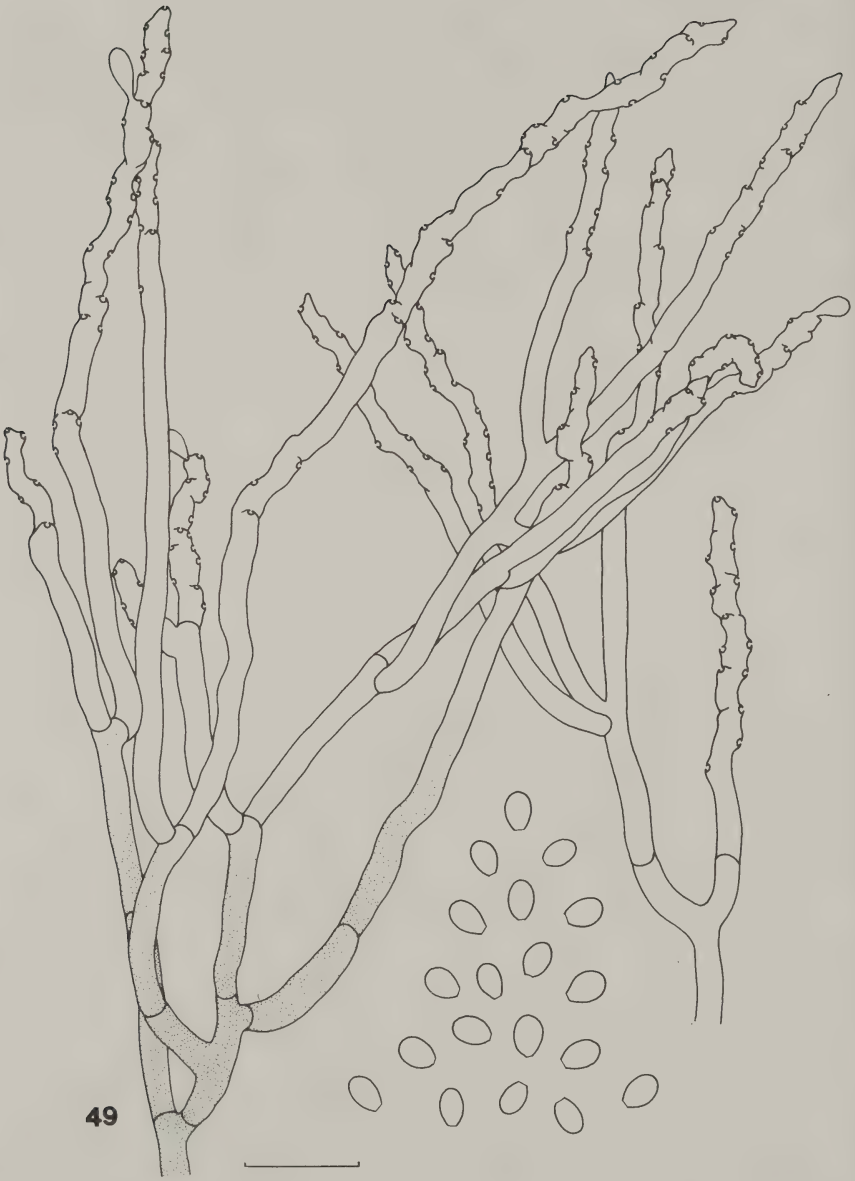

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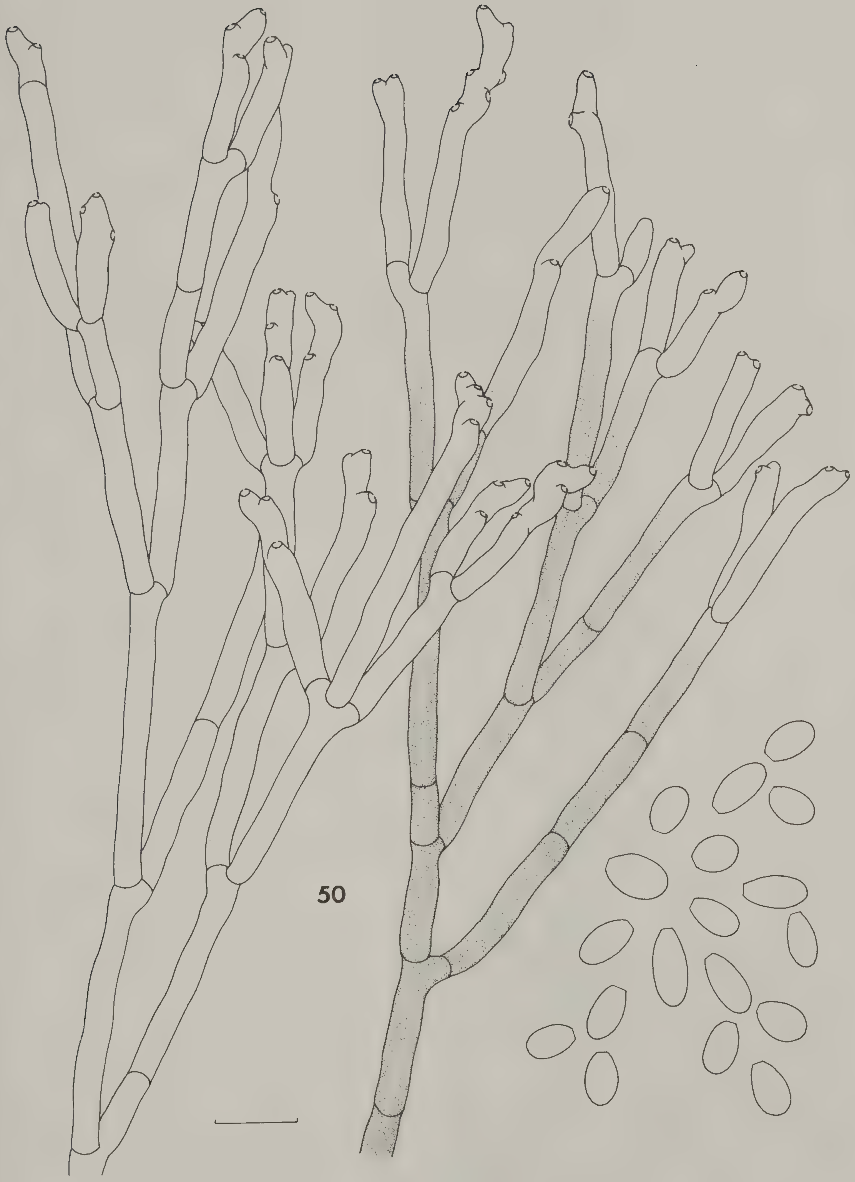

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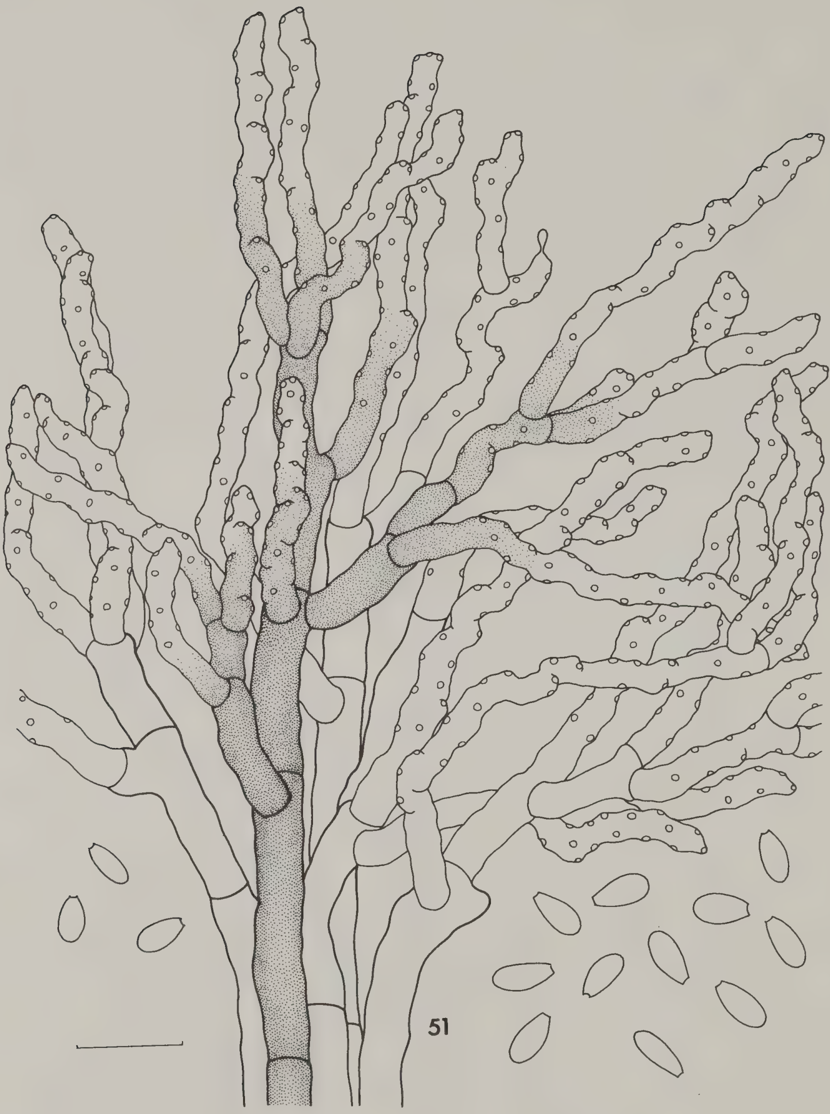
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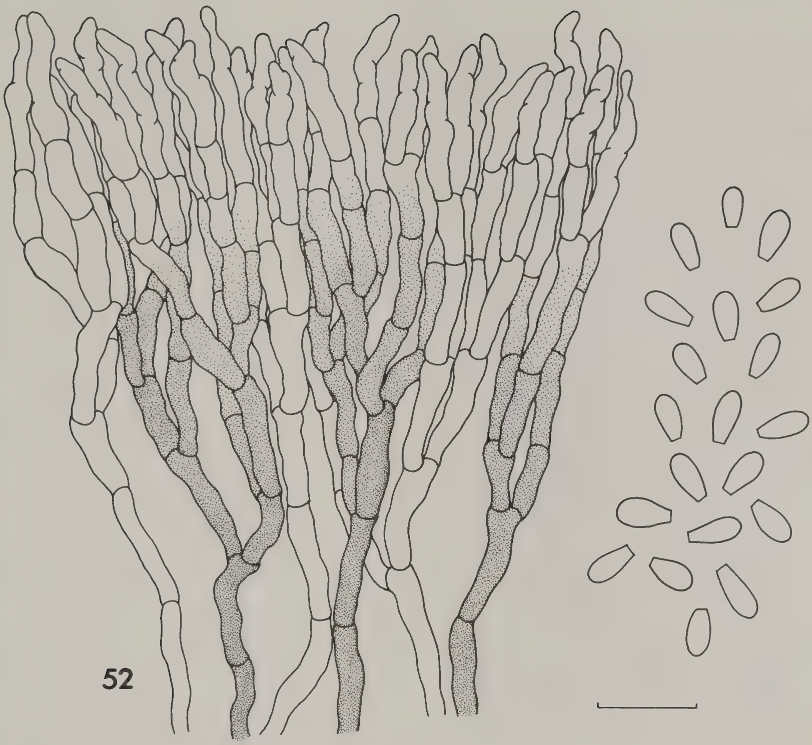

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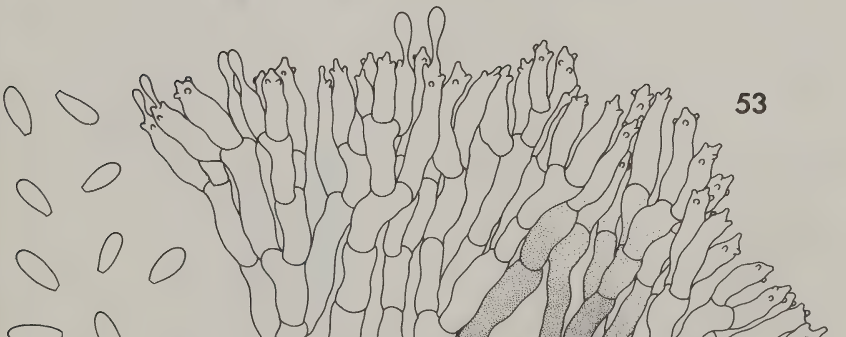

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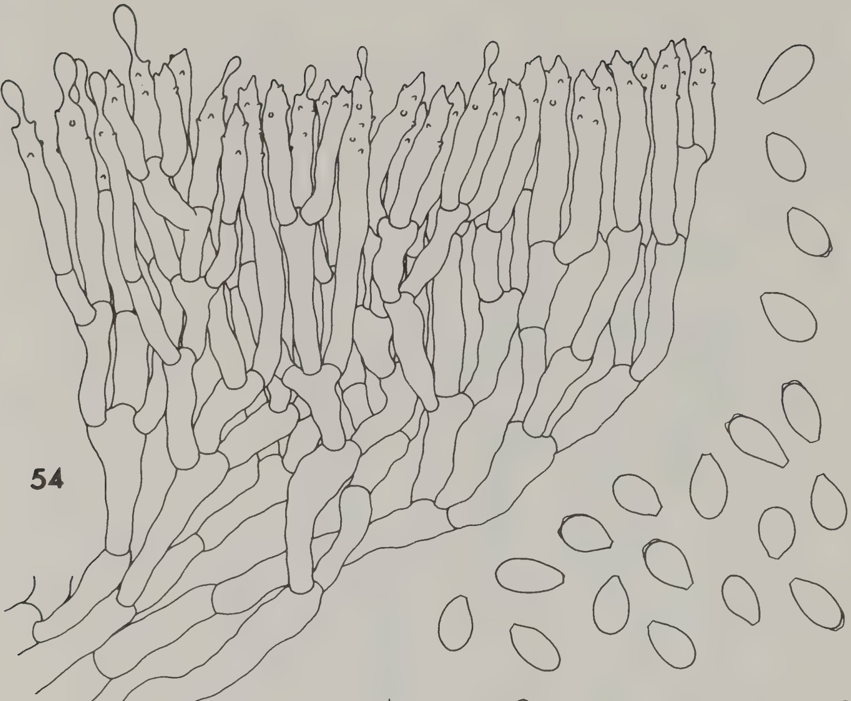

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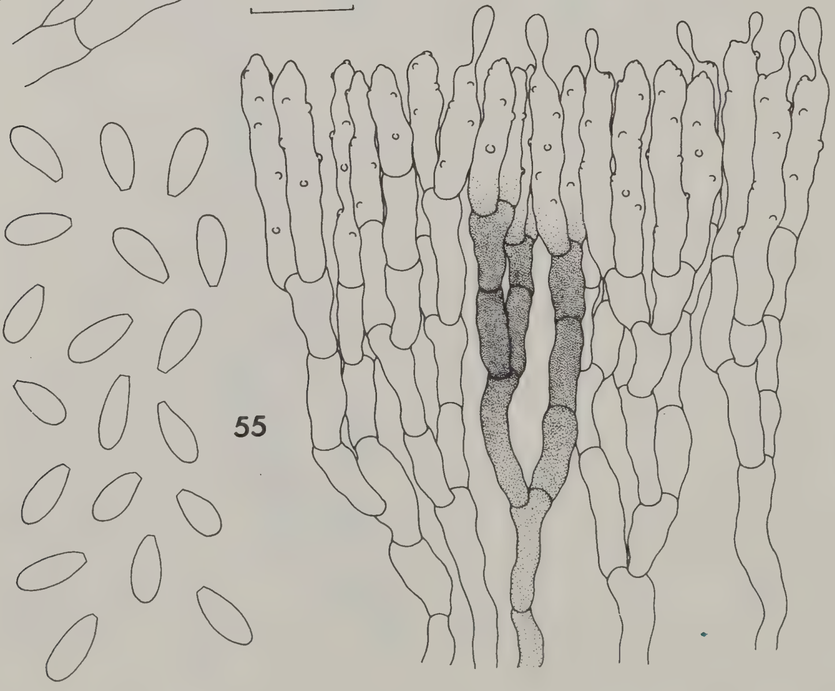

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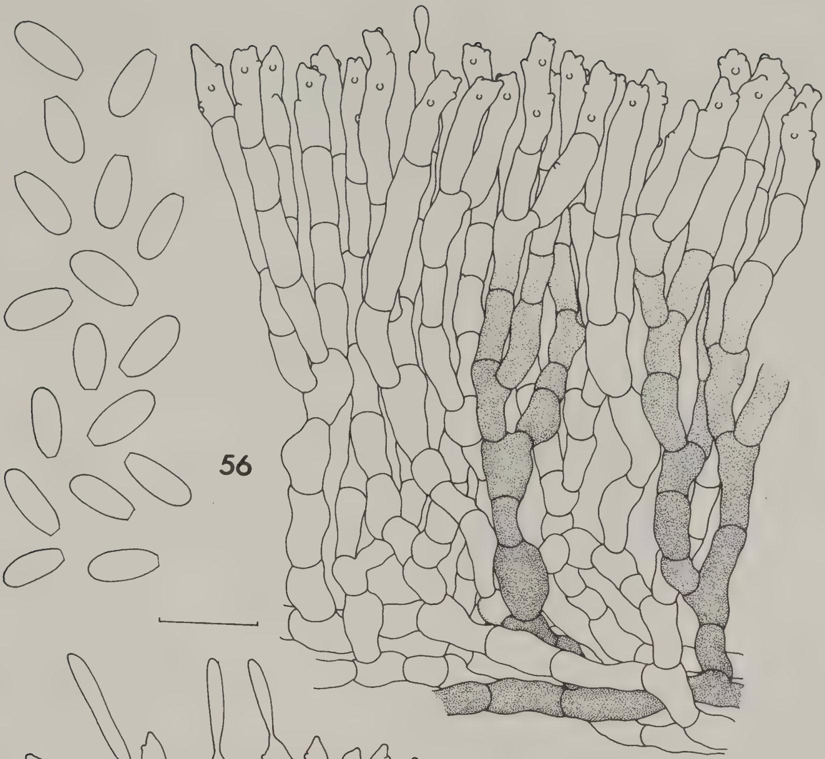

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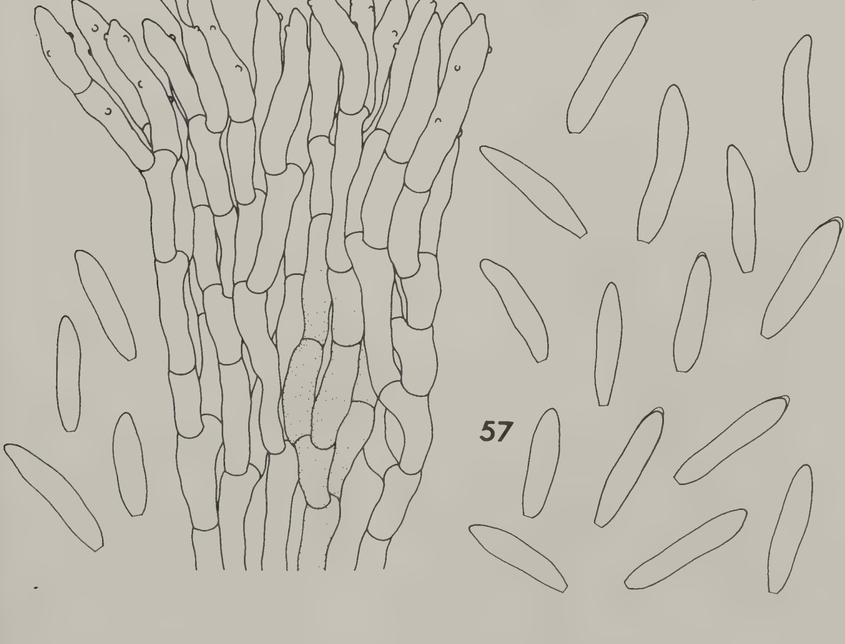

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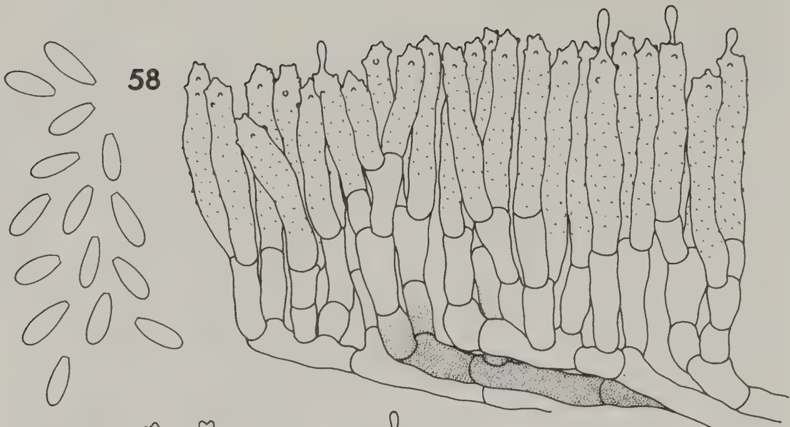

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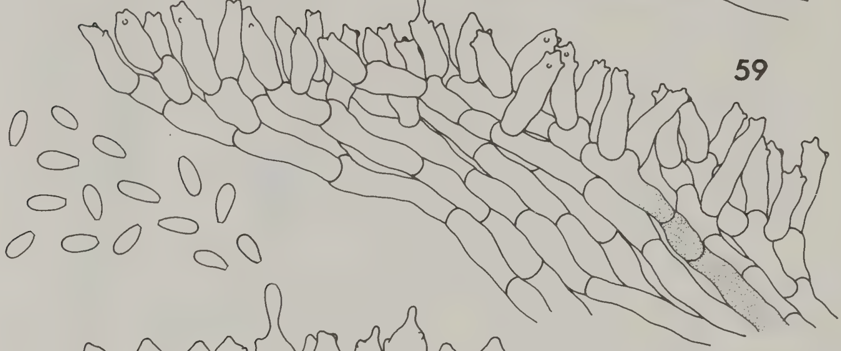

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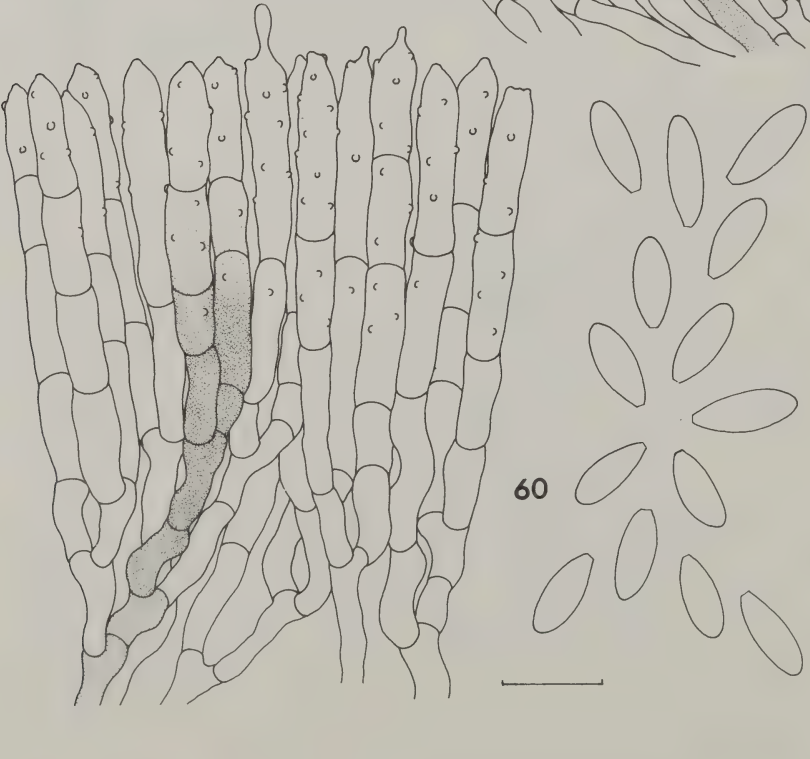

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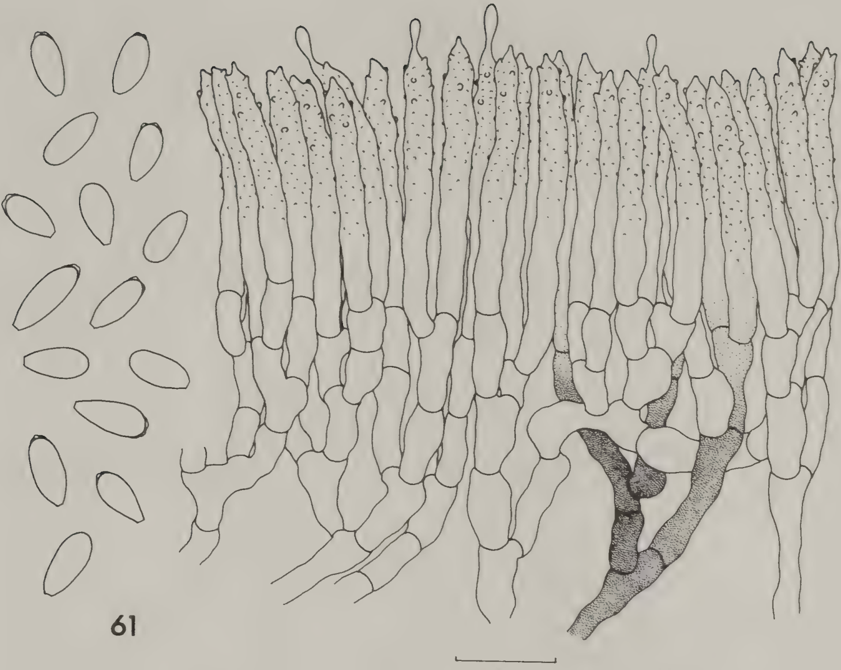

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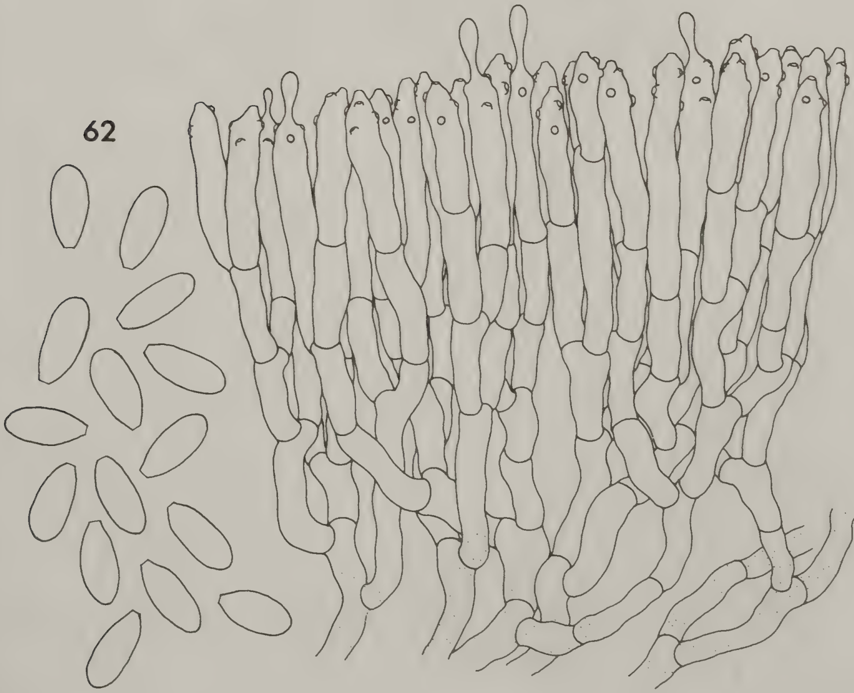

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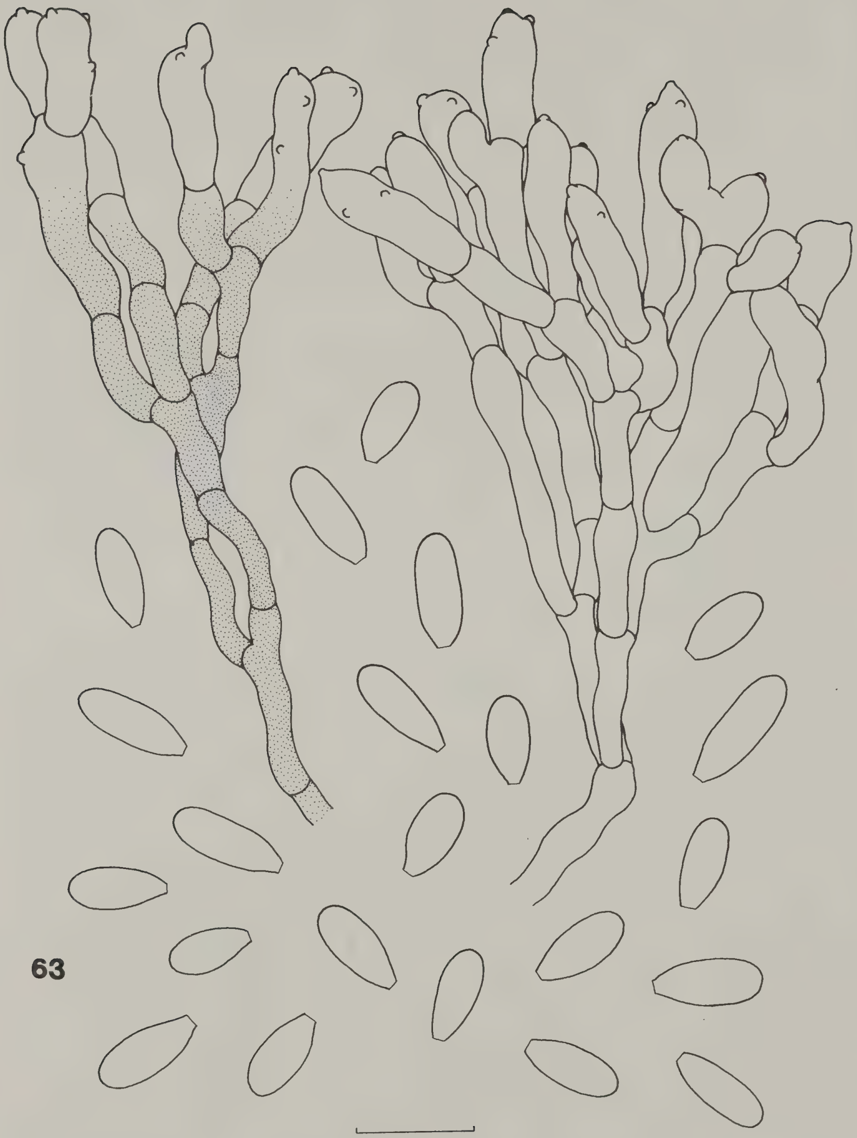

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MYCOTAXON

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EIGHT NEW SPECIES OF XANTHOPARMELIA (LICHENIZED ASCOMYCOTINA, PARMELIACEAE) FROM AUSTRALIA

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ABSTRACT : The following new taxa are described from Australia: *Xanthoparmelia bicolorans* Elix & Kantvilas, *X. hafellneri* Elix, *X. kalbarriensis* Elix, *X. microcephala* Elix & Kantvilas, *X. millerae* Elix, *X. neotucsonensis* Elix, *X. paraparmeliformis* Elix and *X. weberiella* Elix. In addition, *Xanthoparmelia diadeta* (Hale) Hale is reported for the first time from Australia.

Introduction

The lichen genus *Xanthoparmelia* (Vain.) Hale includes all the obligately saxicolous and terricolous species of *Parmelia sens. lat.* with small spores (6-14 x 4-8 µm), usnic or isousnic acid in the upper cortex and cell walls containing *Xanthoparmelia*-type lichenan (Elix 1993a, 1994; Hale 1990). *Xanthoparmelia* is further characterized by a lack of pseudocyphellae, mainly simple rhizines, narrow, sublinear, eciliate lobes, short bifusiform (4-9 µm) or rarely bacilliform (4-14 µm) conidia, an upper cortex consisting of palisade plectenchyma with a pored epicortex, medullary chemical diversity, and a distinctly temperate distribution centred in the Southern Hemisphere.

A synopsis of this genus was published by Hale (1990) where he considered *Xanthoparmelia* to comprise 406 species with the major centres of speciation being Southern Africa (202 species) and Australia (145 species). Further species have been recognized in the intervening years (Brusse 1991, 1993, 1994; Elix 1993b, 1995, 1996, 1997a, 1997b, 1997c; Elix *et al.* 1999; Elix & Kantvilas 1995, 1999; Elix & Nash 1999; Kurokawa 1989a, 1989b, 1989c; Sharma & Kurokawa 1990), but a number of species remain to be described.

This report presents descriptions of eight new species from Australia. Throughout the present work chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson *et al.* 1981; Culberson & Johnson 1982; Elix & Ernst-Russell 1993; Elix *et al.* 1988), high performance liquid chromatography (Elix *et al.* 1997; Feige *et al.* 1993) and comparison with authentic samples.

Xanthoparmelia bicolorans Elix & Kantvilas, sp. nov. Fig. 1

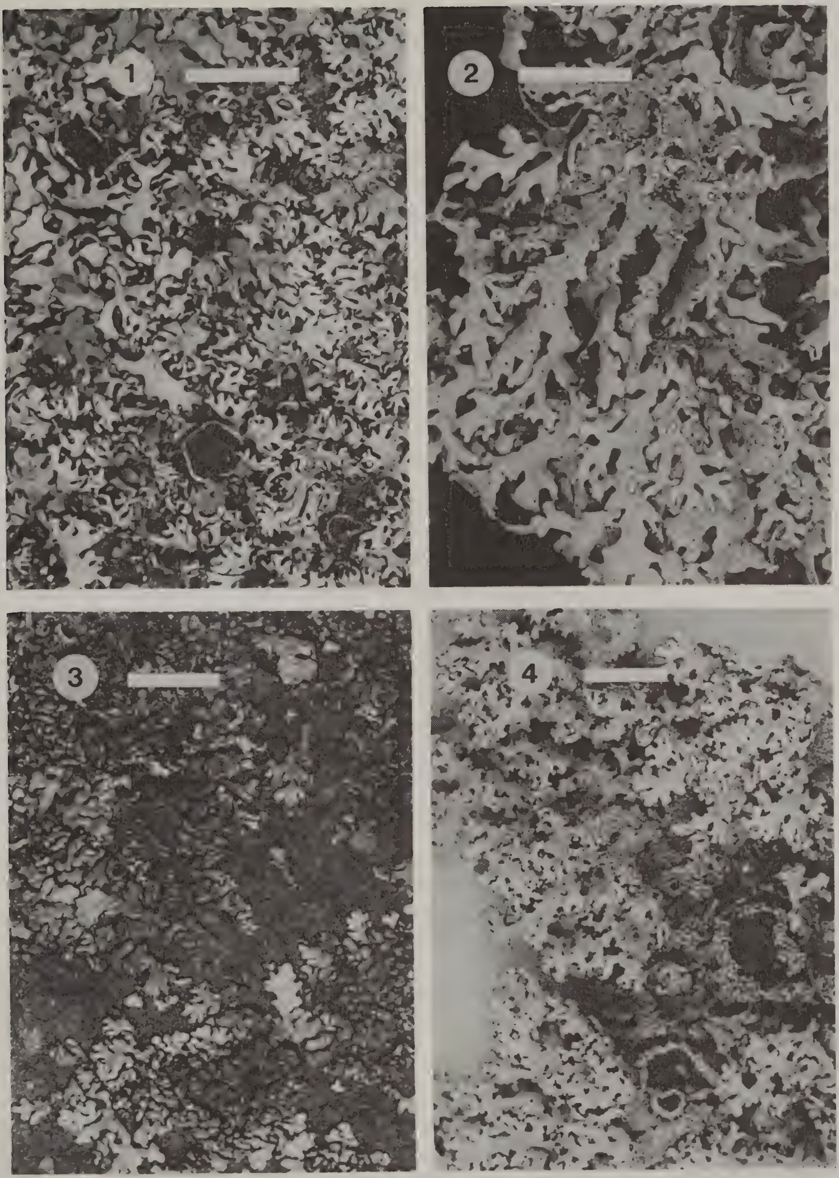
A *Xanthoparmelia elixii* habitu arcte adnato, lobis et sporis angustioribus et pagina inferiore ad marginem nigra differt.

Type: Australia. Victoria: Mt Raymond, 13 km E of Orbost, 37°43'S, 148°36'E, 290 m, on exposed granite rocks in regrowth *Eucalyptus* forest, *J. A. Elix 19454 & H. Streimann*, 27 Sept. 1985; holo: CANB.

Thallus foliose, adnate, to 7 cm wide. *Lobes* imbricate, sublinear, irregularly branched, 0.5-1.5 mm wide, laciniate; laciniae imbricate, sublinear-elongate, subdi- or trichotomously branched, 0.3-0.7(-1.0) mm wide. *Upper surface* yellow-green, darkening with age, flat to slightly concave, emaculate, ±cracked, lacking isidia and soredia; lobe margins often blackened, particularly towards the apices. *Medulla* white. *Lower surface* flat, shiny, rugulose, black or brown-black in a broad marginal zone, brown to pale brown at the thallus centre; rhizines sparse to moderately dense, slender, simple or occasionally tufted, concolorous. *Apothecia* sessile, to 3 mm wide; disc concave, becoming flattened, dark brown; thalline exciple smooth, thin, ±crenulate. *Ascospores* ellipsoid, 7-9 x 4.5-5.5 µm. *Pycnidia* common, immersed. *Conidia* bifusiform, 6-8 x 0.7 µm.

Chemistry. Cortex K-, medulla K+ yellow then red, C-, P+ yellow-orange; containing usnic acid (minor), norstictic acid (major), connorstictic acid (minor/trace).

This species is distinguished by the narrow lobes with a black or brown-black lower surface at or near the periphery of the thallus, but a brown to pale brown lower surface within and at the centre of the thallus, the lack of isidia and soredia, the development of narrower, sublinear-elongate laciniae and the production of norstictic and connorstictic acids in the medulla. The colour of the lower surface is considered a fundamental character in the systematics of *Xanthoparmelia*. In that respect, *X. bicolorans* is unusual in having a lower surface that varies in colour, hence the specific epithet 'bicolorans'. *Xanthoparmelia bicolorans* has previously been confused with *X. elixii* Filson, because of their similar growth habit, morphology and chemistry. However, *X. elixii* differs in being loosely adnate, with broader lobes (1.5-3.0 mm *cf.* 0.5-1.5 mm wide) and laciniae (0.7-1.5 mm *cf.* 0.3-1.0 mm wide), by a lower surface which is ivory to pale brown ±throughout and sparsely rhizinate, and by the wider spores (8-9 x 6-7 µm *cf.* 7-8 x 4.5-5.5 µm



Figures 1-4. New species of *Xanthoparmelia:* 1, X. *bicolorans* (holotype in CANB); 2, X. *hafellneri* (holotype in GZU); 3, X. *kalbarriensis* (holotype in CANB); 4, X. *microcephala* (holotype in HO). Scale bar = 5 mm.

wide). This species appears to be scattered on rocks in the cooler areas of south-eastern Australia.

Specimens Examined (Paratypes)

AUSTRALIA. Victoria: Mt Delegate, 8 km SSW of Delegate, 37°07'S, 148°54'E, 1300 m, on rocks in *Eucalyptus pauciflora* dominated woodland, *J. A. Elix 19359 & H. Streimann,* 26.ix.1985 (CANB).
Tasmania: road to Tooms Lake, 21 km from Ross near Trefusiss, 42°11'S, 147°36'E, 250 m, on dolerite rocks in open dry *Eucalyptus* woodland, *G. Kantvilas 129/99,* 30.iii.1999 (HO); above Black Gully Creek, 1 km NE of Hamilton, 42°33'S, 146°51'E, 140 m, loosely attached on soil in degraded *Eucalyptus pauciflora* woodland, *G. Kantvilas 243/99,* 3.vi.1999 (HO).

Xanthoparmelia hafellneri Elix, sp. nov. Fig. 2

A *Xanthoparmelia scabrosa* lobis lobulatis et atranorinum continenti differt.

Type: Australia. New South Wales: Tweed Range, Border Ranges National Park, The Pinnacle, NE of Wiangaree, 28°23'S, 153°07'E, *ca.* 1000 m, on basaltic rocks on ridge, *J. Hafellner 19136, P. Merrotsy & R. W. Rogers,* 31 Aug. 1986; holo: GZU; iso: CANB.

Thallus foliose, loosely adnate, to 4 cm wide. *Lobes* loosely imbricate, sublinear-elongate, subdi- or subtrichotomously branched, 1.0-2.0 mm wide; occasionally with narrower laciniae along the margins or in the centre of the thallus, laciniae 0.5-1.0 mm wide. *Upper surface* dull yellow-green, more or less flat, emaculate, without soredia; with laminal isidia and lobules; isidia moderately dense, subglobose or rarely short-cylindrical, simple, apices epicorticate, intact, pale; lobules scattered, flattened, 0.1-0.3 mm wide. *Medulla* white. *Lower surface* shiny, smooth or rugulose, pale brown to chocolate brown, darker at apices; rhizines very sparse, simple, dark brown. *Apothecia* and pycnidia not seen.

Chemistry. Cortex K+ pale yellow, medulla K-, C-, KC+ rose, P-; containing atranorin (minor), usnic acid (minor), norlobaridone (major), loxodin (minor).

This taxon is distinguished by the narrow lobes with a brown lower surface, the development of subglobose isidia and lobules on the upper surface, the cortical atranorin and usnic acid and the medullary loxodin and norlobaridone. In *X. hafellneri* the apices of the isidia are pale and epicorticate, but remain intact and do not become erumpent. Morphologically this new species is similar to the very common *Xanthoparmelia scabrosa* (Taylor) Hale, but the latter differs in that the apices of the isidia are erumpent, the upper surface is elobulate and the upper cortex does not contain atranorin. At present this new species is known only from the type locality. It is named in honour of the Austrian lichenologist and collector, Dr Josef Hafellner.

Xanthoparmelia kalbarriensis Elix, sp. nov. Fig. 3

A *Xanthoparmelia norpraegnans* isidiis cylindricis, apicibus syncorticatis nonerumpentibusque differt.

Type: Australia. Western Australia: Z Bend, Murchison River Canyon, Kalbarri National Park, on exposed sandstone, *H. T. Lumbsch 5534d,* 29 Aug. 1987; holo: CANB; iso: PERTH.

Thallus small-foliose to subcrustose, tightly adnate, to 3 cm wide. *Lobes* barely imbricate or not so, flat, sublinear to subirregular, irregularly branched, 0.5-1.0 mm wide, lacking laciniae. *Upper surface* yellow-green or darkening with age, dull, shiny towards the lobe apices, emaculate, lacking soredia; older lobes with tangential or irregular cracks, becoming areolate, isidiate; isidia cylindrical, simple or sparingly branched, with apices syncorticate, not inflated, ±eroding but not sorediose. *Medulla* white. *Lower surface* pale brown to brown, darker at the apices; rhizines sparse to moderately dense, simple, concolorous. *Apothecia* and *pycnidia* not seen.

Chemistry. Cortex K+ pale yellow; medulla K+ yellow then red, C-, P+ yellow; containing atranorin (minor), usnic acid (minor), norstictic acid (major), connorstictic acid (trace), methyl pseudonorstictate (trace), constipatic acid (major), protoconstipatic acid (major).

This species was previously confused with X. *norpraegnans* Elix & J.Johnst. since both species have tightly adnate, subcrustose thalli, lobes with isidia on the upper surface, a brown lower surface and contain norstictic acid as the major medullary substance. However, these species are clearly distinguished by the nature of the isidia. Thus the isida are slender, cylindrical, simple or sparingly branched and with non-inflated, syncorticate apices in X. *kalbarriensis*, but are coarse, globose or rarely short-cylindrical, unbranched and with inflated, epicorticate apices in X. *norpraegnans*. At present this new species is only known from the type locality.

Xanthoparmelia microcephala Elix & Kantvilas, sp. nov. Fig. 4

A *Xanthoparmelia antleriformis* habitu laxe adnato, lobis latioribus et sporis majoribus differt.

Type: Australia. Tasmania: Little Swanport River, *ca.* 4 km west of bridge on Tasman Highway, 42°20'S, 147°53'E, 10 m, on dolerite boulder along river bank in dry sclerophyll forest, *G. Kantvilas 37/93,* 17 May 1993; holo: HO.

Thallus foliose, adnate to loosely adnate, to 10 cm wide. *Lobes* imbricate, ±congested, flat, subirregular to sublinear, subirregularly to subdichotomously branched, 0.8-1.5 mm wide. *Upper surface* yellow-green or darkening with age, shiny, emaculate, smooth at margins, becoming rugose in the centre, lobe margins blackened; without soredia but isidiate; isidia laminal and ±marginal, cylindrical, short, slender, 0.02-0.05 mm wide, not inflated, becoming coralloid, apices syncorticate, pale or darkening. *Medulla* white. *Lower suface* shiny, pale tan to brown, darker at apices; rhizines sparse to moderately dense, simple, concolorous. *Apothecia* sessile to substipitate, 3-8 mm wide; disc concave, shiny, red-brown to dark brown; thalline exciple smooth, shiny, isidiate, margin entire, rather thin, often disappearing in mature apothecia. Ascospores ellipsoid, 8-10 x 4-6 µm. *Pycnidia* rare, immersed. Conidia bifusiform, 5-6 x 1 µm.

Chemistry: Cortex K-; medulla K+ yellow becoming red, C-, KC-, P+ orange; containing usnic acid, salazinic acid (major), consalazinic acid (minor), norstictic acid (trace), protocetraric acid (trace), protoconstipatic acid (±) and constipatic acid (±).

This species resembles *Xanthoparmelia mexicana* (Gyeln.) Hale, *X. nigrocephala* Kurok. and *X. antleriformis* (Elix) Elix & J.Johnst., as all four species are isidiate, have a pale brown to brown lower surface and contain salazinic acid in the medulla. However, they can be distinguished by the adnation of their thalli, the width of the lobes, the nature of the isidia and the size of the ascospores (see Table 1). Unlike the other three species, the thallus of *X. microcephala* is moderately to loosely adnate, the isidia are cylindrical, very slender and may become coralloid-branched, and the ascospores are relatively large. This new species is quite widely distributed on dead wood and rocks in temperate areas of southern and eastern Australia and has previously been confused with the taxa mentioned above.

Specimens Examined (Paratypes)

AUSTRALIA. Queensland: Herberton-Petford road, 1 km SW of Herberton, 17°23'S, 145°21'E, 1000 m, on quartz rocks in *Eucalyptus* woodland, with old tin workings, *J. A. Elix 16632 & H. Streimann*, 27.vi.1984 (CANB); Wild River, Herberton, 17°23'S, 145°23'E, 880 m, on rocks in shrubby regrowth area beside stream, *J. A. Elix 17003, 17004, 17011, 17015 & H. Streimann*, 1.vii.1984 (CANB); between Breakneck and Quandong Creeks, 24 km WSW of Proserpine, 20°29'S, 148°22'E, 150 m, on basalt rocks in *Eucalyptus-Planchonia* dominated woodland, *J. A. Elix 21158 & H. Streimann*, 2.vii.1986 (CANB).

New South Wales: McCauleys Headland, Coffs Harbour, 30°17'S, 153°09'E, on coastal rocks, *J. A. Elix 3393*, 28.vi.1977 (CANB); Weddin State Forest, 25 km WSW of Grenfell, 34°01'S, 148°01'E, on sandstone rocks in *Callitris* forest, *J. A. Elix 4784*, 14.vii.1978 (CANB); western face of Mt Canobolas, 8 km SW of Orange, 33°21'S, 148°58'E, 1420 m, on volcanic rocks in open *Eucalyptus* woodland, *J. A. Elix 6279*, 8.viii.1979 (CANB).

TABLE 1

A comparison between isidiate *Xanthoparmelia* species with a pale lower surface and containing salazinic acid

Species	lobe width	adnation	isidia	ascospores	habitat in Australia
X. antleriformis	0.3-1.0 mm	adnate to tightly adnate	cylindrical, coralloid to antler-like, pale or black-tipped, 0.05-0.1 mm wide	6-8 x 3.5-4.5 µm	rocks in coastal hinterlands
X. mexicana	1.0-5.0 mm	adnate to tightly adnate	subglobose, pale-tipped, 0.1-0.25 mm wide	8-10 x 6-7 µm	rocks in arid & subarid areas
X. microcephala	0.8-1.5 mm	loosely adnate to adnate	cylindrical, pale or black-tipped, 0.02-0.05 mm wide	8-10 x 4-6 µm	rocks & dead wood in temperate areas
X. nigrocephala	1.0-2.5 mm	adnate to tightly adnate	subglobose, black-tipped, 0.05-0.1 mm wide	6-8 x 4.5-5 µm	rocks in alpine areas

Australian Capital Territory: Stirling Park, Yarralumla, 35°18'S, 149°12'E, 600 m, on porphyry outcrop, *J. Burmeister*, 2.vi.1975 (CANB); Molonglo Gorge Reserve, 16 km E of Canberra, 35°16'S, 149°16'E, 580 m, on charred log in dry sclerophyll forest, *J. A. Elix 908*, 11.vi.1975 (CANB); 1 km N of Mt Stromlo, 12 km W of Canberra, 35°19'S, 149°00'E, 700 m, on dead wood in open *Eucalyptus-Casuarina* woodland, *J. A. Elix 33227*, 8.xi.1992 (CANB).
Tasmania: Prosser River dam site, 42°34'S, 147°51'E, on bottle glass and dolerite in open *Eucalyptus* woodland, *G. C. Bratt & R. C. Weeks 68/573*, 4.viii.1968 (HO); Coles Bay Road, 20 m, on dolerite in dry sclerophyll forest, *G. Kantvilas 493/80*, 25.x.1980 (HO); Okehampton Bay, Triabunna, 10 m, on dolerite in coastal pasture, *G. Kantvilas 221/81*, 4.iv.1981 (HO); Brown Mountain Road, Campania, 42°35'S, 147°29'E, 220 m, on burnt *Eucalyptus* wood in *Acacia mearnsii* open woodland, *G. Kantvilas & P. W. James 739/81*, 16.viii.1981 (HO); Bonnet Hill, 42°58'S, 147°20'E, 220 m, on rocks, *A. V. Ratkowsky L50*, 17.xii.1980 (HO).
Western Australia: John Forrest National Park, Darling Ranges, 26 km E of Perth, on rocks in open *Eucalyptus* woodland, *J. A. Elix 10671, 10673 & L. H. Elix*, 25.x.1982 (CANB); Stirling Ranges, lookout 1.5 km SW of Mt Gog, 350 m, on rocks in low scrub, *J. A. Elix 10483 & L. H. Elix*, 20.x.1982 (CANB).

Xanthoparmelia millerae Elix, sp. nov. Fig. 5

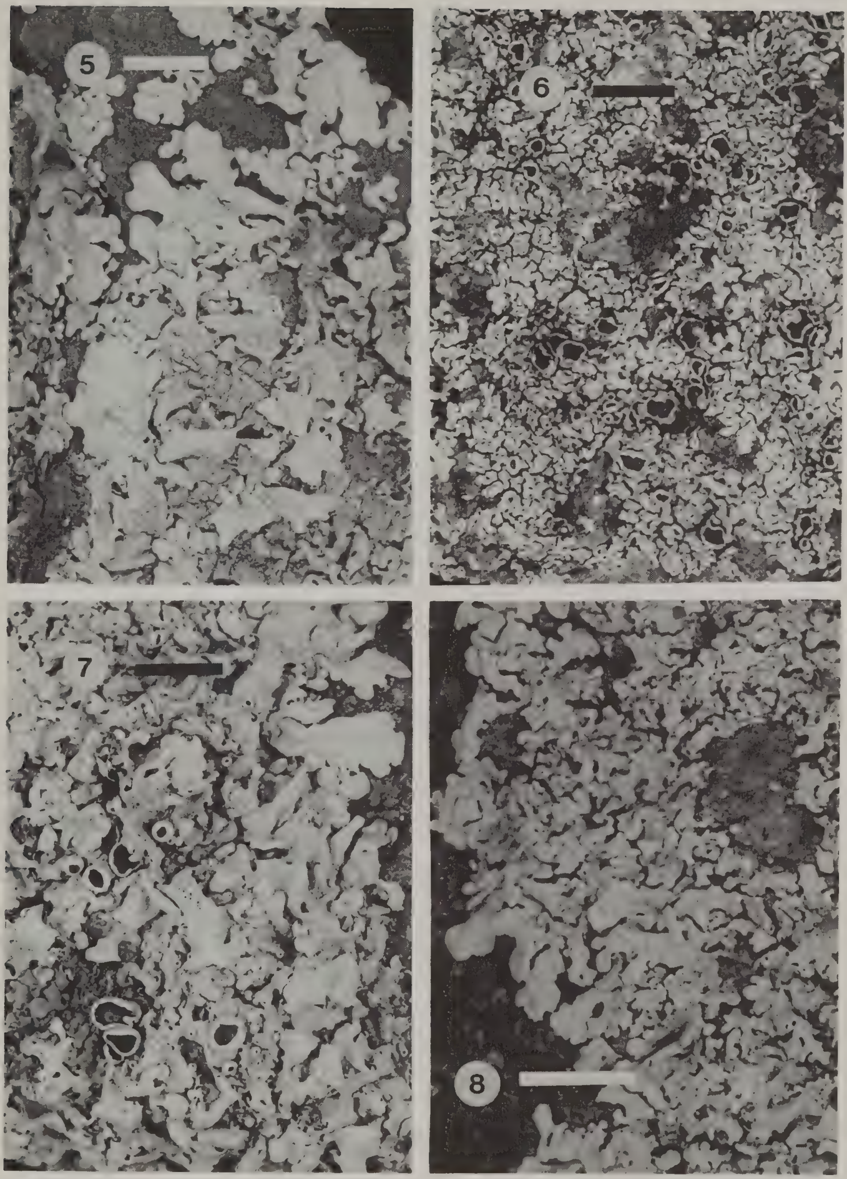
A *Xanthoparmelia filarszkyana* norlobaridonum et loxodinum noncontinenti differt.

Type: Australia. New South Wales: 4 km NNE of Nymagee on Hermitage Road, rocky outcrops at south end of range, 33°03'S, 146°21'E, 380 m, on stones on ground in *Callitris* and *Eucalyptus* woodland, *C. H. Miller 322*, 25.ix.1985; holo: CANB.

Thallus foliose, adnate to tightly adnate, to 5 cm wide. *Lobes* barely imbricate, sublinear to subirregular, irregularly branched, 1-3 mm wide, laciniae lacking; marginal lobes with rotund apices. *Upper surface* pale yellow-green, darkening with age, shiny or dull, flat, emaculate, lacking soredia and isidia; older central lobes becoming rugose and ±cracked. *Medulla* white. *Lower surface* flat, pale tan to brown, darkening near the apices of the lobes; rhizines sparse, short, slender, simple, concolorous. *Apothecia* not seen. *Pycnidia* common, black, immersed. Conidia bifusiform, 6-7 x 0.7-1.0 µm.

Chemistry. Cortex K-; medulla K-, C-, KC-, P-; containing usnic acid.

This species belongs to the *Xanthoparmelia lineola* (Berry) Hale complex, a group of species characterized by their tightly adnate thalli, broad marginal lobes with rotund apices, the pale tan to brown lower surface of the lobes and by the upper surface of the older lobes often being transversely cracked.



Figures 5-8. New species of *Xanthoparmelia:* 5, *X. millerae* (holotype in CANB); 6, *X. neotucsonensis* (holotype in MEL); 7, *X. paraparmeliformis* (holotype in CANB); 8, *X. weberiella* (holotype in CANB). Scale bar = 5 mm.

This new species is only known from the type collection, and differs from all other species of this group in lacking medullary substances.

Xanthoparmelia neotucsonensis Elix, sp. nov. Fig. 6

A *Xanthoparmelia tucsonensis* lobis sublinearibus angustioribusque et sporis minoribus differt.

Type: Australia. South Australia: Musgrave Ranges, Ernabella Airport, 3.3 km E of Ernabella on Kenmore Park Road, 26°16'S, 132°09'E, on small granite outcrop, *R. B. Filson 15703 & S. Filson*, 26 Nov. 1975; holo: MEL.

Thallus foliose to subcrustose, tightly adnate, to 7 cm wide. *Lobes* contiguous, flat, subirregular, becoming irregularly buckled and distorted, irregularly branched, 0.7-2.0 mm wide, laciniae lacking; apices ±subrotund. *Upper surface* yellow-green, dull, shiny towards the lobe apices, emaculate, lacking soredia and isidia; older lobes with transverse or irregular cracks, areolate. *Medulla* white. *Lower surface* pale brown to brown; rhizines moderately dense, simple, concolorous. *Apothecia* numerous, sessile, 1-3 mm wide, disc concave, dark brown; thalline exciple smooth, entire. Ascospores ellipsoid, 7-9 x 3.5-5.5 µm. *Pycnidia* common, immersed. Conidia bifusiform, 6-8 x 0.5 µm.

Chemistry. Cortex K-; medulla K-, P-, C-, KC-; containing usnic acid, diffractaic acid (major), barbatic acid (trace), 4-*O*-demethylbarbatic acid (trace).

This species was previously confused with *Xanthoparmelia tucsonensis* (Nash) Egan since both species have tightly adnate thalli, lobes which lack maculae, isidia and soredia on the upper surface, have a brown lower surface and contain diffractaic acid as the major medullary substance. *Xanthoparmelia tucsonensis*, however, is clearly distinguished from *X. neotucsonensis* by having broader (2.0-3.5 mm *cf.* 0.7-2.0 mm wide), irregular lobes with rotund apices, longer spores (11-12 µm *cf.* 7-9 µm) and minor, but consistent chemical differences. Whereas 3-α-hydroxybarbatic acid, squamatic acid and ±2-*O*-methylobtusatic acid are present in *X. tucsonensis*, they have not been observed in *X. neotucsonensis*. At present this new species is only known from the type locality.

Xanthoparmelia paraparmeliformis Elix, sp. nov. Fig. 7

A *Xanthoparmelia filarszkyana* lobis laciniatis et acidum isousnicum continenti differt.

Type: Australia. Australian Capital Territory: Shepherds Lookout above Murrumbidgee River, 15.5 km W of Canberra, 35°15'S, 148°58'E, 560 m, on porphyry rocks on dry hillside with *Callitris*, *J. A. Elix 26717*, 10 April 1992; holo: CANB.

Thallus foliose, adnate, to 5 cm wide. *Lobes* imbricate or contiguous, sublinear to subirregular, irregularly branched, 1-2.5 mm wide, laciniate; laciniae short, sublinear, 0.5-1.0 mm wide; marginal lobes with rotund apices. *Upper surface* grey to pale yellow-grey, shiny, ±flat, emaculate, lacking soredia and isidia; older central lobes becoming rugulose, with margins often blackened, rarely lobulate. *Medulla* white. *Lower surface* flat, ivory to pale tan, darkening near the apices of the lobes; rhizines sparse, short, slender, simple, concolorous. *Apothecia* sessile to substipitate, 2-6 mm wide; disc deeply concave and then ±flat, dark brown; thalline exciple smooth, margins entire, involute then ±undulating. Ascospores ellipsoid, 8-10 x 5-6 μm. *Pycnidia* common, black, immersed. *Conidia* bifusiform, 6-7 x 0.7 μm.

Chemistry. Cortex K-; medulla K-, C-, KC+ rose, P-; containing isousnic acid (major), loxodin (minor), norlobaridone (major).

This species belongs to the *Xanthoparmelia lineola* (Berry) Hale complex, a group of species characterized by their adnate to tightly adnate thalli, broad marginal lobes with rotund apices, the pale tan to brown lower surface of the lobes and by the upper surface of the older lobes often becoming rugose and then transversely cracked. This new species differs from all other species of this group in containing isousnic acid rather than usnic acid in the cortex. Chemically and morphologically it most closely resembles *X. filarszkyana* (Gyeln.) Hale, but can readily be distinguished from that species by the colour of the upper surface - being yellow-green in *X. filarszkyana* but distinctly grey with a pale yellowish tinge in *X. paraparmeliformis*. This new species also differs from *X. filarszkyana* in being laciniate; laciniae are absent in the latter. In the field this species can easily be mistaken for a species of *Paraparmelia* because of its growth habit and thalline colour.

Specimen Examined (Paratype)

AUSTRALIA. Australian Capital Territory: Aranda Bushland, 4 km W of Canberra, 35°16'S, 149°13'E, 680 m, on sandstone rocks in dry *Eucalyptus* woodland, *J. A. Elix 43020*, 9.iv.1999 (CANB).

Xanthoparmelia weberiella Elix, sp. nov. Fig. 8

A *Xanthoparmelia weberi* habitu arcte adnato, lobis angustioribus et acidum 4-*O*-demethylnotaticum deficienti differt.

Type: Australia. Northern Territory: south face of Mt Olga near Katatjuta Lookout, 25°18'S, 130°45'E, 630 m, on conglomerate rocks with a southerly aspect, *J. A. Elix 11094 & L. A. Craven*, 10 Sept. 1983; holo: CANB.

Thallus foliose, tightly adnate to adnate, to 7 cm wide. *Lobes* imbricate or not, subirregular, irregularly branched, 0.8-3.0 mm wide, laciniae lacking; apices generally crenate or shallowly notched. *Upper surface* yellow-green, shiny at least at the margins, flat, emaculate or indistinctly maculate in places, smooth, isidiate, lacking soredia; isidia laminal, moderately dense to dense, globose to short cylindrical, simple or sparingly branched, expanding laterally; isidia apices epicorticate, becoming inflated and ±erumpent, not sorediate. *Medulla* white. *Lower surface* shiny, pale tan to brown, darkening near the apices of the lobes; rhizines sparse to moderately dense, slender, simple, concolorous. *Apothecia* very rare, subpedicellate, 2-4 mm wide; disc deeply concave and then ±flat, dark brown; thalline exciple isidiate. *Ascospores* ellipsoid, 10-12 x 5-6 µm. *Pycnidia* rare, black, immersed. *Conidia* bifusiform, 5-7 x 0.5 µm.

Chemistry. Cortex K-, UV-; medulla K-, C-, KC-, P-; containing usnic acid, hypoprotocetraric acid (major), conhypoprotocetraric acid (minor), ±constipatic acid, ±protoconstipatic acid, ±scabrosin 4,4'-diacetate, ±scabrosin 4-acetate 4'-butyrate, ±scabrosin 4,4'-dibutyrate, ±scabrosin 4-acetate 4'-hexanoate, ±unknowns (trace).

This new species is characterized by the adnate to tightly adnate thalli, the pale brown lower surface, production of inflated, ±erumpent isidia and hypoprotocetraric acid in the medulla. In many respects it resembles *X. weberi* (Hale) Hale from North America and Africa, but the latter species differs in having more loosely adnate thalli, broader lobes (1-5 mm *cf.* 0.8-2 mm wide) and invariably contains 4-*O*-demethylnotatic acid as well as hypoprotocetraric and conhypoprotocetraric acids in the medulla. By contrast, *X. weberiella* usually contains various scabrosin derivatives in addition to hypoprotocetraric and conhypoprotocetraric acids. *Xanthoparmelia weberiella* is a widespread species in the arid and subarid inland areas of Australia.

Specimens Examined (Paratypes)

AUSTRALIA. Queensland: Highlands Station S of Emmet (railway siding W of Blackall), on road to springs *ca.* 6 km S of homestead, 25°00'S, 144°23'E, 300 m, on rocks in mulga scrub, *M. E. Ballingall 2282B,* 26.ix.1986 (CANB). South Australia: Flinders Ranges, Mt Chambers Gorge, 50 km S of Balcanoona Homestead, 30°58'S, 139°17'E, 350 m, on rocks along rocky ridge with scattered dwarf trees, *J. A. Elix 18096 & L. H. Elix,* 1.xi.1984 (CANB). Northern Territory: Mutitjula, Maggie Springs, Ayers Rock, 25°18'S, 130°45'E, 630 m, on sheltered sandstone rocks with a south-westerly aspect, *J. A. Elix 11159, 11161 & L. A. Craven,* 10.ix.1983 (CANB); type locality, on conglomerate rocks with a southerly aspect, *J. A. Elix 11093, 11096, 11099 & L. A. Craven,* 10.ix.1983 (CANB); Macdonnell Range, 1 km N of Glen Helen Tourist Camp, 24°41'S, 132°41'E, 640 m, on sandstone rocks with a southerly aspect in mulga scrub, *J. A. Elix 11257 & L. A. Craven,* 16.ix.1983 (CANB). Western Australia: Wiluna area, *L. A. Craven 5099,* 10.ix.1983 (PERTH).

New Record for Australia

Xanthoparmelia diadeta (Hale) Hale, *Phytologia* **28**: 487 (1974).
Previously known from South Africa.

Specimens Examined

AUSTRALIA. Queensland: Lannercost State Forest, Poverty Creek, Old Mill Road, 44 km WSW of Ingham, 18°43'S, 145°47'E, 620 m, on granite rocks in *Eucalyptus* dominated forest, *J. A. Elix 15602 & H. Streimann,* 19.vi.1984 (CANB); Mt Windsor Tableland, 37 km NW of Mossman, 16°17'S, 145°05'E, 1100 m, on exposed rocks in *Eucalyptus* and *Casuarina* woodland, *J. A. Elix 16574 & H. Streimann,* 26.vi.1984 (CANB); Herberton-Petford Road, 1 km SW of Herberton, 17°23'S, 145°21'E, 1000 m, on quartz rocks in *Eucalyptus* woodland, *J. A. Elix 16624 & H. Streimann,* 27.vi.1984 (CANB); Cooktown Road, 3 km NW of Mt Molloy, 16°40'S, 145°19'E, 450 m, on granite rocks in *Eucalyptus* dominated grassland, *J. A. Elix 17190, 17194 & H. Streimann,* 3.vii.1984 (CANB); Running River, Paluma Reservoir - Hidden Valley track, 35 km SSW of Ingham, 18°56'S, 146°04'E, 880 m, on rocks in grazing land with some *Eucalyptus, J. A. Elix 20316 & H. Streimann,* 18.vi.1986 (CANB); Mt Farrenden, 26 km SSW of Charters Towers, 20°19'S, 146°13'E, 450 m, on sandstone rocks in dry sclerophyll forest, *J. A. Elix 20573 & H. Streimann,* 19.vi.1984 (CANB); Plover Plain, Mt Fox to Kennedy Development Road, 45 km N of Greenvale, 18°34'S, 144°55'E, 600 m, on rock outcrop in *Leptospermum* dominated seasonal swampy area, *H. Streimann, 46827f* 19.xii.1990 (CANB).

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LITERATURE CITED

Brusse, F. (1991). Eight new species in the lichen genus *Parmelia* (Parmeliaceae, Ascomycotina) from southern Africa, with notes on southern African lichens. *Mycotaxon* **40**: 377-393.

Brusse, F. (1993). Eight new species in the lichen genus *Parmelia* (Parmeliaceae, Ascomycotina) from southern Africa, with notes on southern African lichens. *Mycotaxon* **49**: 1-17.

Brusse, F. (1994). Four new species in the lichen genus *Parmelia* (Ascomycotina, Lecanorales) from southern Africa, with notes on southern African lichens. *Mycotaxon* **50**: 291-299.

Culberson, C. F. (1972). Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *Journal of Chromatography* **72**: 113-125.

Culberson, C. F. & Johnson, A. (1982). Substitution of methyl *tert.*-butyl ether for diethyl ether in the standardized thin-layer chromatographic method for lichen products. *Journal of Chromatography* **238**: 483-487.

Culberson, C. F., Culberson, W. L. & Johnson, A. (1981). A standardized TLC analysis of β-orcinol depsidones. *Bryologist* **84**: 16-29.

Elix, J. A. (1993a). Progress in the generic delimitation of *Parmelia s. lat.* lichens (*Ascomycotina: Parmeliaceae)* and a synoptic key to the Parmeliaceae. *Bryologist* 96: 359-383.

Elix, J. A. (1993b). New species in the lichen family Parmeliaceae (Ascomycotina) from Australia. *Mycotaxon* **47**: 101-129.

Elix, J. A. (1994). *Xanthoparmelia*. *Flora of Australia* **55**: 201-308.

Elix, J. A. (1995). New species in the lichen family Parmeliaceae (Ascomycotina) from Australasia and Malaysia. *Mycotaxon* **56**: 231-241.

Elix, J. A. (1996). New species in the lichen family Parmeliaceae (Ascomycotina) from Australasia and Oceania. *Mycotaxon* **59**: 407-417.

Elix, J. A. (1997a). New species and new combinations in the lichen family Parmeliaceae (Ascomycotina) from South Africa. *Mycotaxon* **63**: 335-343.

Elix, J. A. (1997b). Further new species in the lichen family Parmeliaceae (Ascomycotina) from Australasia. *Mycotaxon* **63**: 419-430.

Elix, J. A. (1997c). Further new species in the lichen family Parmeliaceae (Ascomycotina) from Australasia. *Mycotaxon* **65**: 481-491.

Elix, J. A., & Ernst-Russell, K. D. (1993). *A Catalogue of Standardized Thin Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances,* 2nd Edn. (Australian National University, Canberra).

Elix, J. A. & Kantvilas, G. (1995). New taxa and new records from the Tasmanian lichen flora. *Papers and Proceedings of the Royal Society of Tasmania* **129**: 63-68.

Elix, J. A., & Kantvilas, G. (1999). Two new species of *Xanthoparmelia* from Australasia (Ascomycotina, Parmeliaceae). *Mycotaxon* **71**: 89-93.

Elix, J. A. & Nash, T. H. III (1999). Two new species of *Xanthoparmelia* (Ascomycotina, Parmeliaceae) from North America. *Mycotaxon* **71**: 417-422.

Elix, J. A., Becker, U. & Follmann, G. (1999). New species of *Neofuscelia* and *Xanthoparmelia* (Lichenized Ascomycotina, Parmeliaceae) from Zimbabwe. *Mycotaxon* **71**: 1-12.

Elix, J. A., Johnston, J. & Parker, J. L. (1988). A computer program for the rapid identification of lichen substances. *Mycotaxon* **31**: 89-99.

Elix, J. A., Wardlaw, J. H., Archer, A. W., Lumbsch, H. T. & Plümper, M. (1997). Four new depsidones from *Pertusaria* and *Lecanora* lichens. *Australasian Lichenology* **41**: 22-27.

Feige, G. B., Lumbsch, H. T., Huneck, S. & Elix, J. A. (1993). The identification of lichen substances by a standardized high-performance liquid chromatographic method. *Journal of Chromatography* **646**: 417-427.

Hale, M. E. (1990). A synopsis of the lichen genus *Xanthoparmelia* (Vainio) Hale (Ascomycotina, Parmeliaceae). *Smithsonian Contributions to Botany* **74**: 1-250.

Kurokawa, S. (1989a). New or noteworthy species of *Xanthoparmelia* (Parmeliaceae). *Annals of the Tsukuba Botanical Garden* **8**: 21-25.

Kurokawa, S. (1989b). Studies on Japanese species of *Xanthoparmelia* (Parmeliaceae) (1). *Journal of Japanese Botany* **64**: 165-175.

Kurokawa, S. (1989c). Studies on Japanese species of *Xanthoparmelia* (Parmeliaceae) (2). *Journal of Japanese Botany* **64**: 289-298.

Sharma, L. R. & Kurokawa, S. (1990). Species of *Xanthoparmelia* in Nepal. *Journal of Japanese Botany* **65**: 58-60.

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NOTES ON THE GENUS ECHIDNODELLA (ASTERINACEAE)

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ABSTRACT: This paper summarizes information available in the literature for species assigned to the genus *Echidnodella*, listing for each species synonyms, plant host, geographical distribution, and tabulating sizes of important morphological features. It is not a systematic treatment of the genus, but rather is preliminary to such a work.

KEY WORDS: Dothidiales, Microthyriaceae, *Echidinodella*, *Echidnodes*, *Lembosia*, *Lembosina*, *Morenoella*.

INTRODUCTION

The genus *Echidnodella* Theissen and Sydow was established in 1917 with *E. linearis* as the type species. It was distinguished from the genus *Echidnodes* on the basis of a lack of paraphyses in *Echidnodella.* Both of these genera produce mycelia lacking hyphopodia, distinguishing them from the morphological similar hyphopodiate genera *Lembosia* and *Morenoella.* The latter genus is considered a synonym of *Lembosia* by Mueller and von Arx (1962).

At least thirty-three species have been assigned to the genus *Echidnodella* at one time or another. Hawksworth *et al*. (1995) list the number of valid species as seven, apparently following Mueller and von Arx (1962), but it does not appear that these authors included in their assessment all described species. To determine whether all species presently assigned to *Echidnodella* are appropriately placed will require extensive herbarium study, not only of species assigned to *Echidnodella*, but also of the species presently assigned to *Lembosia, Lembosina (= Echidnodes)* and *Morenoella*, which is beyond the scope of the present study.

My interest in *Echidnodella* developed during the study of a leaf inhabiting fungus collected in Hawaii (Goos and Uecker, 1992). Dr. Uecker determined that fungus should be assigned to *Echidnodella* .In an effort to assign the fungus to an appropriate species, literature pertaining to the genus *Echidnodella* was assembled and analyzed. The results of that effort are presented in this paper, arranged, where appropriate, in tabular form.

No new combinations are made; rather, this paper attempts to lay a ground work for future systematic study.

RESULTS

Echidnodella Theissen and Sydow. 1918. Ann. Mycol. 15: 422.
Type species: *E. linearis* Sydow

Mycelium dark, conspicuous, entirely superficial, lacking hyphopodia, sending haustoria into epidermal cells; pseudothecia (thyrothecia) elongated, opening by a longitudinal slit; asci bitunicate, elongate to globose, 8-spored; ascospores one-septate, becoming brown (description derived from key by Luttrell, 1973).

Doidge (1920) and Stevens and Ryan (1939) mention that *Echidnodella* is aparaphysate but this characteristic is not addressed in Luttrell's key.

DESCRIBED SPECIES

1. *Echidnodella africana* (Doidge) Arx. Müller and von Arx. Die Gattungen der didymosporen Pyrenomyceten. p. 117. 1962.
Synonyms: *Morenoina africana* Doidge. Trans. Roy. Soc. S. Afr. 8: 242. 1920.
Echidnodes africana (Doidge) Doidge. Bothalia 4: 324. 1942.
Host: *Dryopteris inaequalis* Pteridophyta.
Distribution: South Africa.
Reference: Müller and J. von Arx. 1962.

2. *Echidnodella angustiformis* (Tracy and Earle) F. Stevens and R. W. Ryan. The Microthyriaceae, p. 98. 1939.
Synonyms: *Lembosia angustiformis* Tracy and Earle. Bull. Torr. Bot. Club 22: 176: 1895.
Morenoella angustiformis (Tracy and Earle) Theiss. Ann. Mycol. 11: 415, 1913.
Lembosia ilicis Tracy and Earle. Bull. Torr. Bot. Club 23: 208. 1896.
Morenoella ilicis (Tracy and Earle) Theiss. Ann. Mycol. 11: 451. 1913.
Host: On *Ilex*, Aquifoliaceae.
Distribution: USA (Mississippi).
Reference: Stevens and Ryan. 1939.

3. *Echidnodella camphorae* (Earle) Theiss. and Syd. Ann. Mycol. 15: 422. 1917.
Synonyms: *Morenoella camphorae* (Earle) Theiss. Ann. Mycol. 11: 452. 1913.
Lembosia camphorae Earle. Bull. Torr. Bot. Club 27: 123: 1900.
Host: *Camphora* Lauraceae.
Distribution: USA (Florida).
Reference: Stevens and Ryan. 1939.

4. *Echidnodella cedralensis* Toro. Chardón and Toro. Mycol. Explor.Venezuela. p.101. 1934.
Synonym: *Morenoella ramosii* Syd.
Host: *Rapanaea*, Myrsinaceae.
Distribution: Venezuela.
Reference: Chardón and Toro. 1934.

5. ***Echidnodella cavendishiae*** Toro. Ann. Mycol. 32: 111. 1934.
Host: *Cavendishia*, Vacciniaceae.
Distribution: Colombia.
Reference: Stevens and Ryan. 1939.

6. ***Echidnodella cocculi*** F. Stevens and R. W. Ryan. Bernice P. Bisop Mus. Bull. 19: 76. 1925.
[Listed as *Lembosina cocculi* (F. Stevens & R. W. Ryan) Arx. Müller and von Arx. 1962]
Synonym: *Maurodothella cocculi* (F. Stevens and R. W. Ryan) Arnaud. Ann. Crypt. Exot. 4: 84. 1931.
Host: On *Cocculus*, Memispermaceae.
Distribution: Hawaii.
Reference: Stevens and Ryan. 1939; Müller and von Arx. 1962.

7. ***Echidnodella crustacea*** (Cooke) Arx. Müller and von Arx. Die Gattungen der didymosporen Pyrenomyceten. p.118. 1962.
Synonyms: *Asterina crustacea* Cooke. Grevillea 14:13. 1885.
Lembosia crustacea (Cooke) Theiss. Ann. Mycol. 11: 432. 1913.
Echidnodes crustacea (Cooke) Hansf. Reinwardtia 3: 119. 1954.
Lembosia congregata Syd. Ann. Mycol. 8: 40. 1910.
Lembosia diffusa subsp. *breviuscula* Penz. and Sacc. Malpighia 11: 527. 1898.
Lembosia breviuscula (Penz. and Sacc.) Syd. Ann. Mycol. 2: 162. 1904.
Morenoella breviuscula (Penz. and Sacc.) Höhn. Sitzungsber. K. Ak. Wiss. Wien, math.-nat. Kl., 1 Abt., 118: 1515
Morenonella gedeana Racib. Parasit. Algen und Pilze Javas 3: 28. 1900.
Dimerosporium pangerangense Henn. Monsunia 1: 159. 1899.
Host: *Rhododendron sp.*, Ericaceae.
Distribution: Indonesia, Philippines.
Reference: Müller and von Arx. 1962.

8. ***Echidnodella damnacanthi*** Katum. Bull. Fac. Agric. Yamaguti Univ. 26: 86. 1975.
Host: On *Damnacanthus indici,* Rubiaceae.
Distribution: Japan.
Reference: Katumoto. 1975.

9. ***Echidnodella diaphana*** Toro. Ann. Mycol. 32: 111. 1934.
Host: On *Conomorpha*, Myrsinaceae.
Distribution: Colombia.
Reference Stevens and Ryan. 1939.

10. ***Echidnodella dipterocarpi*** (Henn.) Theiss. and Syd. Ann. Mycol. 15: 422. 1917.
Synonyms: *Lembosia dipterocarpi* Henn. Hedwigia 47: 261. 1907.
Morenoella dipterocarpi (Henn.) Theiss. Ann. Mycol. 11: 457. 1913.
Host: On *Dipterocarpus*, Dipterocarpaceae.
Distribution: Philippines.
Reference: Stevens and Ryan.1939.

11. ***Echidnodella furcraeae*** R. W. Ryan. Mycologia 16: 195. 1924. [as *fourcroyae]*
Host: *Fourcroya*, Amaryllidaceae.
Distribution: Puerto Rico.
Reference: Stevens and Ryan. 1939.
Orthography: *fide* Crane and Jones, 1997.

12. ***Echidnodella guatemalensis*** Bat., Nascim. and Peres. An. Soc. Biol. Pernambuco 16: 133.1959.
Host: On *Anona*, Anonaceae.
Distribution: Central America.
Reference: Müller and von Arx. 1962.

13. ***Echidnodella hopeae*** Hosag. and al. Mycotaxon 58: 497. 1996.
Host: On *Hopea ponga*, Dipterocarpaceae.
Distribution: India.
Reference: Hosagoudar and al. 1996.

14. ***Echidnodella hypolepidis*** Doidge. Trans. Roy. Soc. So. Afr. 8: 270. 1920.
Synonym: *Echidnodes hypolepidis* (Doidge) Doidge. Bothalia 4: 324. 1942.
Host: On *Hypolepis sparsisora*, Cyperaceae.
Distribution: South Africa.
References: Stevens and Ryan. 1939; Müller and von Arx. 1962.

15. ***Echidnodella imadae*** Goos and Uecker. Mycologia 84: 325. 1992.
Host: On *Canthium odoratum*, Rubiaceae.
Distribution: Hawaii.
Reference: Goos and Uecker. 1992.

16. ***Echidnodella linearis*** (Syd.) Theiss. and Syd. Ann. Mycol. 15: 422. 1917. [type species]
Synonym: *Morenoella linearis* Syd. Ann. Mycol. 1: 250.1903.
Host: *Cynometra*, Leguminosae.
Distribution: Philippines.
Reference: Stevens and Ryan. 1939; Müller and von Arx. 1962.

17. ***Echidnodella lucumae*** Arx. Univ. Recife. Inst. Micol., Publ. 288: 14. 1960.
Host: On *Lucuma grandifolia,* Sapotaceae.
Distribution: Brazil.
Reference: Müller and von Arx. 1962.

18. ***Echidnodella mabae*** F. Stevens and R. W. Ryan. Bernice P. Bishop Mus. Bull. 19: 76. 1925.
Synonym: *Lembosia mabae* (F. Stevens and R. W. Ryan) Arnaud. Ann. Crypt. Exot. 4: 84. 1931.
Host: On *Maba*, Ebenaceae.
Distribution: Hawaii.
Reference: Stevens and Ryan. 1939.

19. ***Echidnodella marattiae*** (Racib.) Theiss and Syd. Ann. Mycol. 15: 422. 1917.
Synonym: *Morenoella marattiae* Racib. Parasit. Algen und Pilze Javas 2: 19.1900.
Host: On *Marattia*, Pteridophyta.
Distribution: Indonesia.
Reference: Stevens and Ryan. 1939.

20. ***Echidnodella melastomacearum*** R. W. Ryan. Mycologia 16: 195.1924.
Host: On *Miconia*, Melastomataceae.
Distribution: Puerto Rico.
Reference: Stevens and Ryan.1939.

21. ***Echidnodella miconiae*** R. W. Ryan. Mycologia 16: 195.1924.
Host: *Miconia*, Melastomataceae.
Distribution: Puerto Rico.
Reference: Stevens and Ryan. 1939.

22. ***Echidnodella myrciae*** R.W. Ryan. Mycologia 16: 195.1924.
Host: *Myrcia*, Myrtaceae.
Distribution: Puerto Rico.
Reference: Stevens and Ryan.1939.

23. ***Echidnodella natalensis*** (Doidge) Arx. Müller and von Arx, Die Gattungen der didymosporen Pyrenomyceten. p.117. 1962.
Synonyms: *Lembosia natalensis* Doidge. Trans. Roy. Soc. S. Afr. 8: 268. 1920.
Echidnodes natalensis (Doidge) Doidge. Bothalia 4: 323.1942.
Host: On *Eugenia zuluensis*, Myrtaceae.
Distribution: South Africa.
Reference: Müller, E., and J. A. von Arx. 1962

24. ***Echinodella nephrodii*** (Racib.) Bat. and Lima. Rev. Biol. Lisboa 2: 98. 1960.
Synonym: *Morenoella nephrodii* Racib. Parasit. Algen und Pilze Java, II, p. 19, 1900.
Host: On *Nephrodium heterophylla (= Dryopteris),* Pteridophyta.
Distribution: Indonesia (Java).
Reference: Index of Fungi 3: 79.

25. ***Echidnodella prinoides*** (Tracy and Earle) Theiss. and Syd. Ann. Mycol. 15: 422. 1917.
Synonyms: *Morenoella prinoides* (Tracy and Earle) Theiss. Ann. Mycol. 11: 451. 1913.
Lembosia prinoides Tracy and Earle. Bull. Torr. Bot. Club 22: 176. 1895.
Host: On *Ilex*, Aquifoliaceae.
Distribution: USA (Mississippi).
Reference: Stevens and Ryan. 1939.

26. ***Echidnodella psychotriae*** Katum. Bull Fac. Agric. Yamaguti Univ. No. 26, p. 86-87. 1975.
Host: On *Psychotria serpens*, Rubiaceae.
Distribution: Japan.
Reference: Katumoto, 1975.

27. ***Echidnodella raillardiae*** F. Stevens and R. W. Ryan. Bernice P. Bishop Mus. Bul. 19: 76. 1925.
Host: On *Raillardia (= Dubautia sp.)*, Compositae
Distribution: Hawaii.
Reference: Stevens and Ryan. 1939.

28. ***Echidnodella ramosii*** (Syd.) F. Stevens. The Microthyriaceae, p. 99, 1939.
Synonym: *Morenoella ramosii* Syd. Ann. Mycol. 12: 560. 1914.
Host: On *Pentacme*, Dipterocarpaceae.
Distribution: Philippines.
Reference: Stevens and Ryan. 1939.

29. ***Echidnodella rapanaeae*** Hino and Katum.. Bull. Fac. Agric. Yamaguti Univ. 8: 639. 1957.
Host: On *Rapanaea nerifolia* , Myrsinaceae.
Distribution: Japan.
Reference: Katumoto. 1975.

30. ***Echidnodella reticulata*** (Starbäck) Theiss. and Syd. Ann. Mycol. 15: 422. 1917.
Synonym: *Morenoella reticulata* Starbäck. Bih. K. Svensk. Vet.-Akad. Handl. 25: 18. 1899.
Host: On *Vismia*, Guttiferaceae.
Distribution: Brazil.
Reference: Stevens and Ryan. 1939.

31. ***Echindnodella roundeletiae*** R. W. Ryan. Mycologia 16: 195. 1924.
Host: *Rondeletia*, Rubiaceae.
Distribution: Puerto Rico.
Reference: Stevens and Ryan. 1939.

32. ***Echidnodella rugispora*** (Tracy and Earle) Theiss. and Syd. Ann Mycol.15: 422. 1917.
Synonyms: *Morenoella rugispora* (Tracy and Earle) Theiss. Ann. Mycol. 11: 452. 1913.
Lembosia rugispora Tracy and Earle. Bull. Torr. Bot. Club 22: 208. 1896.
Host: On *Persea*, Lauraceae.
Distribution: USA (Mississippi).
Reference: Stevens and Ryan. 1939.

33. ***Echidnodella syzygimae*** Subhedar and V. G. Rao. J. Univ. Poona 50: 26. 1977
Host: On *Syzgium cumini*, Myrtaceae.
Distribution: India.
Reference: Subhedar and Rao. 1977.

Table I. Geographic distribution of *Echidnodella* species

country (region)	**species**
Brazil	*E. lucumae, E. reticulata*
Central America	*E. guatamalensis*
Colombia	*E. cavendishiae, E. diaphana*
Hawaii	*E. cocculi, E. imadae, E. maba, E. raillardiae*
India	*E. hopeae, E. syzygimae*
Indonesia	*E. crustacea, E. marattiae, E. nephrodii*
Japan	*E. damnacanthi, E. psychotriae, E. rapanaeae*
North America (USA)	*E. angustiformis, E. camphorae, E. prinoides, E. rugispora*
Philippines	*E. crustacea, E. linearis, E. dipterocarpi, E. ramosii*
Puerto Rico	*E. furcraeae, E. melostomacearum, E. miconiae, E. myrciae, E. roundeletiae*
South Africa	*E. africana, E. hypolepidis, E. natalensis*
Venezuela	*E. cedralensis*

Table II. Plant hosts for species of *Echidnodella*

host family	**genus (genera)**	**species**
1. Amaryllidaceae	*Fourcroya*	*E. furcraaeae*
2. Anonaceae	*Anona*	*E. guatamalensis*
3. Aquifoliaceae	*Ilex*	*E. angustiformis* *E. prinoides*
4. Compositae	*Raillardia*	*E. raillardiae*
5. Cyperaceae	*Hypolepsis*	*E. hypolepidis*
6. Dipterocarpaceae	*Dipterocarpus* *Hopea* *Pentacme*	*E. dipterocarpi* *E . hopeae* *E. ramosii*
7. Ebenaceae	*Maba*	*E. mabae*
8. Ericaceae	*Rhododendron*	*E. crustacea*
9. Guttiferaceae	*Vismia*	*E. reticulata*
10. Leguminosae	*Cynometra*	*E. linearis*
11. Lauraceae	*Camphora* *Persea*	*E. camphorae* *E. rugispora*
12. Melastomataceae	*Miconia*	*E.melastomacearum* *E. miconiae*
13. Menispermaceae	*Cocculus*	*E. cocculi*
14. Myrsinaceae	*Conomorpha* *Rapanaea*	*E. diaphana* *E. cedralensis* *E. rapanaeae*
15. Myrtaceae	*Eugenia* *Myrcia* *Syzygium*	*E. natalensis* *E. myrciae* *E. syzygimae*
16. Pteridophyta	*Dryopteris* *Marattia*	*E. africana* *E. nephrodii* *E. marattiae*
17. Rubiaceae	*Canthium* *Damnacanthus* *Psychotria* *Rondeletia*	*E. imadae* *E. damnacanthi* *E. psychotriae* *E. rondeletiae*
18. Sapotaceae	*Lucuma*	*E. lucumae*
19. Vacciniaceae	*Cavendishia*	*E. cavendishiae*

Table III. Size of pseudothecia, asci and ascspores of the species of *Echidnodella*

species	ascomata (µm)	asci (µm)	ascospores (µm)
*E. africana**	120-400 x 65-100	23-27 x 10-12	12-14 x 5-6.5
E. angustiformis	120 x 50-80	16-22 x 10-13	8-10 x 4-5
E. camphorae	500 x 100	25 x 20	18 x 6
E. cavendishiae	513-618 x 125-171	34-48 x16-20	13-15 x 6.8
E . cedralensis	280-650 x 140-200	26-30	17-20 x 6-7
E. cocculi	500-600 x 200-284	14-18 x 36-41	21-23 x 14-18
E. crustacea	500 x 230	80 x 40	32-40 x 16-20
E. damnacanthi	215-330 x 110-150	22-25.5 x 16-20	14-16 x 6-7
E. diaphana	239-371 x 137-171	38-45 x 31-34	20-22 x 9-12
E. dipterocarpi	300-500	70-80 x 50-64	40-50 x 18-24
E. furcraeae	112-168 x 324-336	24-28 x 33-36	9 x 17
E. guatamalensis	270-450 x 200-220	45-49 x 32-40	25-30 x 13.5-17
E. hoepae	200-375	46-50	30-32 x 12-15.5
E. hypolepidis	120-240 x 50-100	20-25 x 7-10	10-14 x 3.5-5
E. imadae	200-450 x 50-60	40 x 15-20	14-17 x 5-6
E. linearis	500-1500 x 100-145	28-35 x 12-17	11-14 x 3-4.5
E. lucumae	110-180 x 210-600	28-36	15-21 x 7-10
E. mabae	227-397	33 x 54	21.6 x 7
E. marratiae	300	36-40 x 20-22	26-28 x 5
E. melastomacearum	240-252 x 168-192	41-60 x 29-36	24-26 x 9
E. miconiae	81-185 x 105-125	14-15 x 24-37	17-20 x 3-4
E. myrciae	224-336	14-17 x 9-12	5 x 9
*E. natalensis***	280-450 x 140-170	30-34 x 20-24	17.5-25 x 6-7.5
E. nephrodii	80	48-52 x 40-44	22 x 5-6
E. prinoides	200-350 x 120-150	30-35 x 15-18	10-15 x 4-5
E. psychotriae	210-240	25-30 x 13-16	15-16 x 4.5-5
E. raillardiae	63-72	not included in type description	3.6 x 8
E. ramosii	250-400	50-75 x 40-60	32-38 x 17-20
E. rapanaeae	300-1000 x 150-200	25.3-39 x 23-29.5	22-27 x 6.5-8.5
E. reticulata	250-400 x 74-100	70-80 x 50-64	40-50 x 18-24
E. roundeletiae	228 x 72	27 x 12	7 x 2
E. rugispora	400 x 100	30-45 x 20-25	15-20 x 8-10
E. syzygii	416-768 x 80-134	44-60 x 26-40	24-32 x 12-20

*from description of *Morenoina africana* Doidge

**ascus size taken from description of *Lembosia natalensis* Doidge

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REFERENCES

CRANE, J. L., and A. JONES. 1997. Annotated Catalogue of Types at the University of Illinois Mycological Collections (ILL). Ill. Biol. Monographs 58. Univ. of Ill. Press.

DOIDGE, E. 1920. South African Microthyriaceae. Trans. Roy. Soc. So. Africa. 8: 235-286.

GOOS, R. D., and F. A. UECKER. 1992. New species and additional records of fungi from Hawaii. Mycologia 84: 322-328.

HAWKSWORTH, D. L., P. M. KIRK, B. C. SUTTON and D. N. PEGLER. 1995. Dictionary of the Fungi. International Mycological Institute, Wallingford.

HOSAGOUDAR, V. B., M. P. BALAKRISHNAN and R. D. GOOS. 1996. Some *Asterinella*, *Asterostomella* and *Echidnodella* species from southern India. Mycotaxon 58: 489-498.

KATUMOTO, K. 1975. The Hemisphaeriales in Japan. Bull. Fac. Agric. Yamaguti University. 26.

LUTTRELL, E. S. 1973. Loculoascomycetes. IN: Ainsworth, G. C., F. K. Sparrow and A. S. Sussman, eds. The Fungi: an advanced treatise, Vol. IV A, pp. 135- 219.

MÜLLER, E., and J. A. von ARX. 1962. Die Gattungen der didymosporen Pyrenomyceten. Beitr. Kryptofamenfl. Schweiz. 11: 192.

RYAN, R. W. 1924. The Microthyriaceae of Porto Rico. Mycologia 16: 177-196.

STEVENS, F. L. 1925. Hawaiian Fungi. Bernice P. Bishop Museum Bulletin 19. Honolulu, Hawaii.

STEVENS, F. L. and M. H. RYAN. 1939. The Microthyriaceae. University of Illinois Press, Urbana, Illinois. 138 pp.

SUBHEDAR, A. W. and V. G. RAO. 1977. Some hitherto undescribed species Ascomycetes from India. J. Univ. Poona. 50.

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CYLINDROCLADIUM PERSEAE SP. NOV.

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ABSTRACT

A fungus characteristic of *Cylindrocladium* was noted sporulating on necrotic leaf spots and blotches of *Persea borbonia* (L.) K. Spreng. Microscopic examination of the fungus revealed the presence of slightly bent conidia in addition to the straight conidia. Single spore isolates were established. All single spore isolates yielded both straight and slightly curved conidia. In older cultures (4-5 weeks), microconidia (straight, slightly bent or sinuous) were produced. Comparison of morphological features of this fungus to those of *Cylindrocladium* spp. that have been reported to produce curved conidia, *C. curvatum* Boedijn & Reitsma, *C. curvisporum* Crous & Victor, *C. flexuosum* Crous, *C. hawksworthii* Peerally, *C. ovatum* El-Gholl, Alfenas, Crous & Schubert, *C. pteridis* Wolf and *C. variabile* Crous, Janse, Victor, Marais & Alfenas, showed differences in vesicle morphology, branching, size and septation of conidia.

Key Words: *Cylindrocladium perseae*, *Persea borbonia*, leaf spot disease.

INTRODUCTION

In October 1997, a sample of *Persea borbonia* (L.) K. Spreng. (red bay) with leaf spots and blotches (Fig. 1) was submitted to the Florida Division of Plant Industry's Plant Pathology Section for diagnosis. Plants showed symptoms of defoliation. A fungus of the genus *Cylindrocladium* was evident on the necrotic tissues. Slightly bent conidia and straight conidia were noted. The object of this study was to characterize the species found on *P. borbonia* and compare its morphological features to those that produce curved conidia.

MATERIALS AND METHODS

Leaf spots and blotches were surface-sterilized with 0.3% sodium hypochlorite for 3 min and plated on acidified potato dextrose agar (APDA, pH 4.3) to inhibit bacterial growth. APDA was prepared from the broth of 200 g of freshly peeled, diced, and boiled Irish potatoes (*Solanum tuberosum* L.) supplemented with 20 g dextrose, 1 g KH_2PO_4, and 18 g Difco Bacto agar and made up to 1 litre with deionized water. After cooling to 50°C, 1.4 ml of 50% lactic acid was added per litre of autoclaved medium to obtain a pH of 4.3. The *Cylindrocladium* from *P. borbonia* was subcultured on peanut (*Arachis hypogaea* L.) stem-water agar (PS-WA) to enhance sporulation (Snyder & Hansen, 1947). PS-WA was prepared by pouring cooled (50°C), autoclaved 1.8% water agar over dried, irradiated pieces of woody peanut stem (4-6 cm long). The stem pieces had been sterilized with 2.5 megarads of gamma irradiation from a Cobalt 60 source. With careful handling, they floated and became partially submerged upon solidification of the agar.

Single conidium isolates were obtained by the method of Hansen and Smith, 1932. Single germinated conidia were transferred to APDA to compare colony morphology and pigmentation at room temperature (25 ± 2°C). Cultures grown on PS-WA were observed over a 6-week period.

Designation of pigmentation was expressed by the Munsell color codes (Munsell Color Company, Inc., 1975). In recording a color by Munsell notation, the symbol for hue is written first, and is followed by a symbol written in fraction form, the numerator indicating the value and the denominator indicating the chroma (H V/C). The hue notation of a color indicates a qualitative change. The value and chroma represent quantitative changes. The value notation indicates the lightness of a color; the higher the number, the lighter the color. The chroma notation indicates the strength of a color, increasing as the numerals increase.

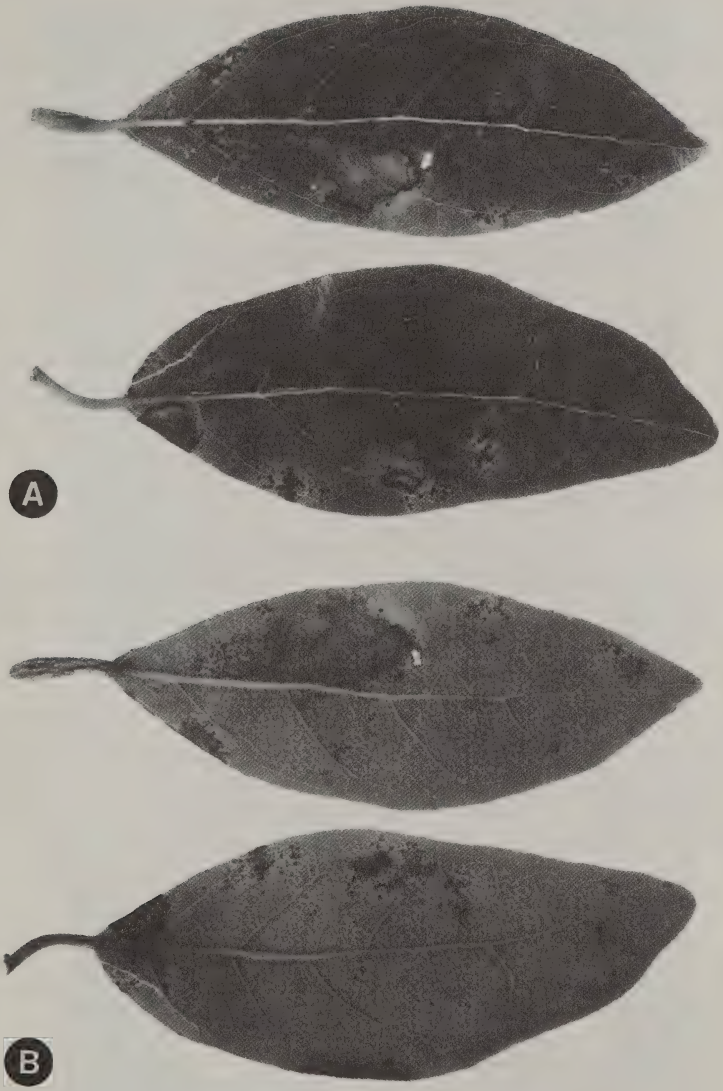

Fig. 1. Leaf spots and blotches on *Persea borbonia* caused by *Cylindrocladium perseae*. A) Upper surfaces X1.2. B) Lower surfaces X1.2.

Microscopic examinations and measurements were made on 82 primary, 83 secondary, 64 tertiary, 40 quaternary and 13 quinary branches, 85 phialides, 181 conidia, 173 microconidia, and 140 vesicles at X 1000 under oil immersion lens. Vesicles were measured from the tip to the first septum and the widest vesicle width was recorded. All of the structures were mounted in water and were measured within 5 min of preparation to avoid swelling and distortion.

RESULTS AND DISCUSSION

The average colony diameter of cultures which were derived from single conidia was 26.3 mm after 6 days on APDA at room temperature. The growth rate of cultures from curved conidia was the same as those from straight conidia. Measurements were made from an equal number of colonies derived from straight and curved conidia. All cultures were fairly uniform in colony morphology.

Colonies viewed from the top had brown center 10YR5/3 with a white perimeter ring 8/1 (Munsell Color Company, Inc., 1975) (Fig. 2A). The bottom of these colonies had mottled dark yellowish brown center 10YR3/4 with very pale brown out ring 8/3 (Munsell Color Company, Inc., 1975) (Fig. 2B).

The species of *Cylindrocladium* from *P. borbonia* has a single filament extending from the main axis of the conidiophore stalk and terminates in an oval to ellipsoidal vesicle, and typically with an umbonate apex (Peerally, 1991) (p 332, Fig. 6 j & m) (Fig. 3 A & B). Up to 5 serial branches are formed (Fig. 3C). Measurements of branches are shown in Table 1.

TABLE 1. Measurements (μm) of conidiophore branches of *Cylindrocladium perseae*

Branches measured	Branches	Length	Width (at midpoint)
82	primary	17.9(11.9-22.8)	4.7(3-5.9)
83	secondary	15.9(10.9-21.3)	4.4(3.5-5.5)
64	tertiary	15.1(10.9-18.8)	4.2(3-5)
40	quaternary	14.5(10.4-18.3)	4.1(3.5-4.8)
13	quinary	14.3(10.9-15.8)	3.9(3-4.5)

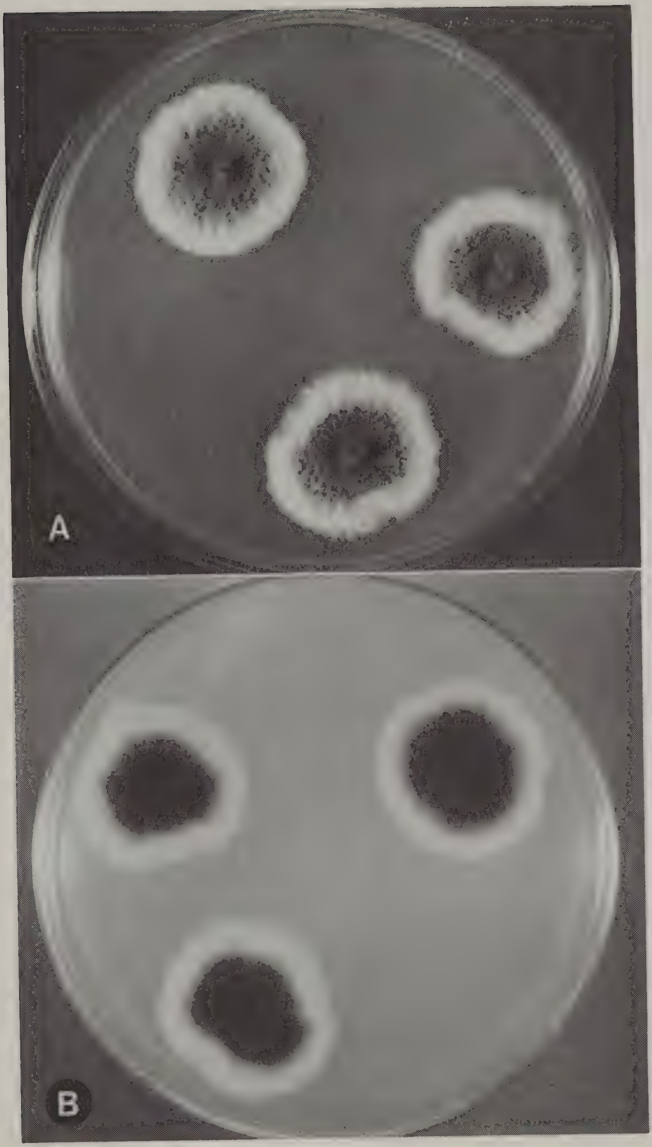

Fig. 2. Colonies of *Cylindrocladium perseae* derived from single conidia after 6 days on potato dextrose agar acidified with lactic acid at room temperature. A) Top X 0.8. B) Bottom X 0.9.

Phialides are hyaline and are doliiform, reniform, or cylindric in shape and measured 12(7.9-15.8)x4.2(3.5-6) µm. Conidia (Fig. 3D) are granular and have up to 7 septa (Fig. 4A). Septa are not always distinct. Conidia measurements are shown in Table 2. They were mostly 3-septate.

TABLE 2. Conidia measurements (µm) of *Cylindrocladium perseae* and the percentage of conidia in each septation category

No. of septa	Conidia measured	% of total	Length	Width (at widest point)
1	2	1.1	68.3(66.3-70.3)	5.2(4.5-5.9)
2	4	2.2	70.1(64.4-74.3)	5.9(5.9-6)
3	148	81.8	70.3(45.1-87.1)	5.5(4-6.3)
4	17	9.4	74.9(66.3-85.1)	5.5(4.5-6.3)
5	6	3.3	74.9(71.3-83.7)	5.7(4.6-6.5)
6	2	1.1	74.3(73.3-75.2)	5.9
7	2	1.1	83.7(83.2-84.2)	5.7

In older cultures (4-5 weeks), microconidia (straight, slightly bent or sinuous) were produced (Fig. 3E). They were mostly (97.7% of total) nonseptate and 1-septate, 0.6% were 2-septate and 1.7% were 3-septate. They measured 24.5(14.1-42.6)x3.5(2-4.2)µm. Cultures that were derived from single conidia yielded both conidia and microconidia on PS-WA. Vesicles were oval to ellipsoidal, and typically with umbonate apices and measured 20.1(14.9-27.2)x7.4(4.5-10.9)µm. Chlamydospores (Fig. 4B) were produced on PS-WA within 4 weeks. They were borne singly, in pairs, in chains or in clusters. This fungus did not produce perithecia on PS-WA.

The species of *Cylindrocladium* from *P. borbonia* produces mostly 3-septate conidia while conidia of *C. curvatum* Boedijn & Reitsma (Boedijn & Reitsma, 1950) and *C. hawksworthii* Peerally (Peerally, 1991) are 1-septate. Conidia of the fungus under study are longer and wider 71.1(45.1-87.1)x5.5(4-6.5)µm than those reported for *C. curvatum* 40-46x3-4µm (Boedijn & Reitsma, 1950) and *C. hawksworthii* 36-62x3-5µm (Peerally, 1991). *C. curvatum*, *C. hawksworthii* and *C. curvisporum* Crous & Victor (Victor *et al.*, 1997) have not

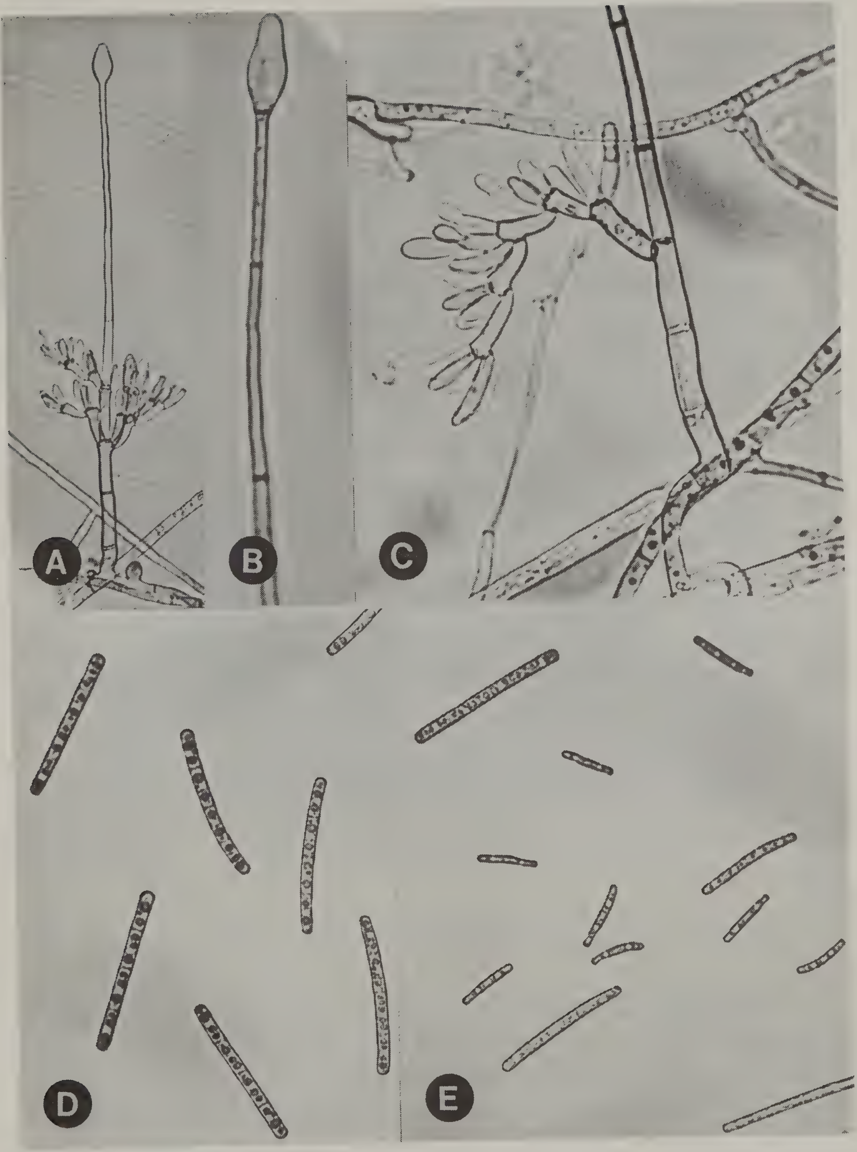

Fig. 3. *Cylindrocladium perseae*. A) Conidiophore showing a single central septate filament X320. B) Vesicle X640. C) Conidiophore showing 5 branches X640. D) Straight and slightly bent conidia X320. E) Conidia and microconidia X320.

been reported to produce microconidia. The fungus from *P. borbonia* produces microconidia in older cultures. It produces oval to ellipsoidal vesicles and typically with umbonate apices while those of *C. flexuosum* Crous and *C. pteridis* Wolf are narrowly clavate (Crous *et al.*, 1995; Sobers, 1968). Vesicles of *C. curvisporum* are sphaeropedunculate (Victor *et al.*, 1997) while those of *C. variabile* Crous, Janse, Victor, Marais & Alfenas are sphaeropedunculate or elliptical to clavate (Crous *et al.*, 1993). In 1968, Sobers described conidia of a "small form" of *C. pteridis* as curved, rounded at both ends, 1-septate, 31.3(23.1-47.6)x3.7(3.4-4.8)μm, and demonstrated that the small form reverted to the large form when transferred to conventional media (Sobers, 1968). Conidia of *C. pteridis* were straight, cylindric, and measured 87.5(61-118)x5.7(4.8-7.5)μm (Sobers, 1968). In our opinion, Sobers was looking at microconidia of *C. pteridis* when he referred to them as the small curved form. Conidia and microconidia of *C. pteridis* could also be straight to slightly curved (Crous *et al.*, 1993, personal communication - P. W. Crous). The teleomorphs of *C. flexuosum*, *C. ovatum* El-Gholl, Alfenas, Crous & Schubert (El-Gholl *et al.*, 1993), *C. pteridis* and *C. variabile* are *Calonectria clavata* Alfieri, El-Gholl & Barnard, *Calonectria ovata* Victor & Crous (Crous *et al.*, 1997), *Calonectria pteridis* Crous, Wingfield & Alfenas and *Calonectria variabilis* Crous, Janse, Victor, Marais & Alfenas (Crous *et al.*, 1993; Crous *et al.*, 1995; Crous *et al.*, 1993) respectively. The *Cylindrocladium* from *P. borbonia*, *C. curvatum*, *C. curvisporum* and *C. hawksworthii* do not produce the sexual state.

Based on the characteristics mentioned above, the *Cylindrocladium* from *P. borbonia* is considered distinct from all *Cylindrocladium* spp. that have been reported to produce curved conidia, so a new species, *Cylindrocladium perseae* is proposed as follows:

Cylindrocladium perseae Schubert, Leahy *et* El-Gholl, sp. nov.

Conidiophora in vesiculam hyalinam, ovalem vel ellipsoideam, et typice apice umbonato, 7.4(4.5-10.9)μm latam terminantia, usque ad 5 ramos seriatim efferentia. Phialides hyalinae, doliiformes, reniformes vel cylindricae, 12(7.9-15.8)x4.2(3.5-6)μm. Conidia recta vel leviter curvata, plerumque 3-septata, 71.1(45.1-87.1)x5.5(4-6.5)μm. Microconidia recta, leviter curvata vel sinuosa, plerumque aseptata et 1-septata, raro 2- vel 3-septata, 24.5(14.1-42.6)x3.5(2-4.2)μm.

Habitatio: Seiuncta a maculis foliorum *Perseae borboniae*.

Locus typicus: Green Cove Springs, Florida, U.S.A.

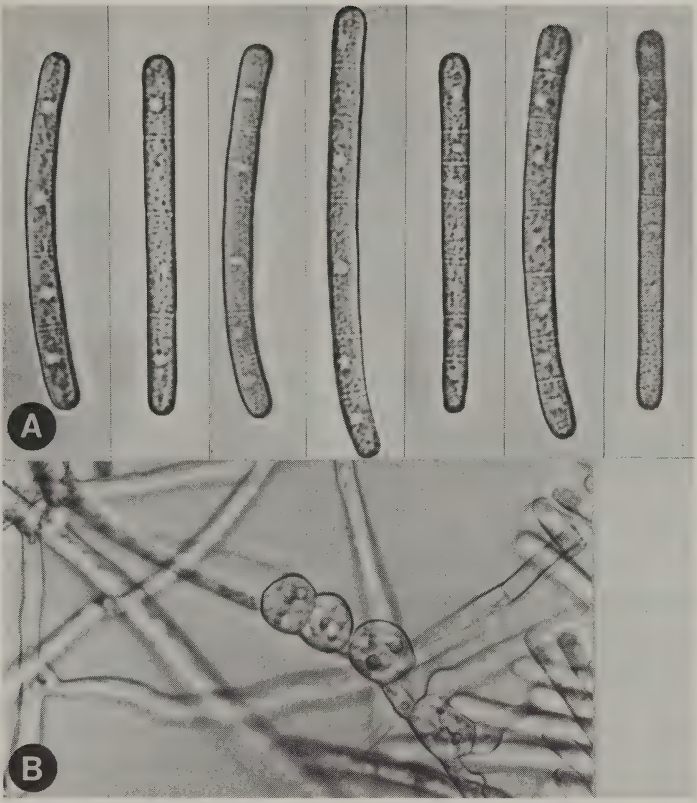

Fig. 4. *Cylindrocladium perseae*. A) Straight and slightly bent conidia showing up to 7 septa X640. B) Chlamydospores X640.

Specimen typicum: FLAS F56789
Typus culturae: ATCC 201792

Collector: D. Chiappini
Datum: Die 17 Octobris, 1997

Cylindrocladium perseae Schubert, Leahy and El-Gholl, sp. nov.

Conidiophore terminating in a hyaline, oval to ellipsoidal vesicle, and typically with an umbonate apex 7.4(4.5-10.9)μm wide. Up to 5 serial branches are formed. Phialides, hyaline, doliiform, reniform or cylindric 12(7.9-15.8)x4.2 (3.5-6)μm. Conidia straight or slightly curved, mostly 3-septate 71.1 (45.1-87.1)x5.5(4-6.5)μm. Microconidia straight, slightly bent or sinuous, mostly nonseptate and 1-septate, rarely 2- or 3-septate 24.5(14.1-42.6)x3.5(2-4.2)μm.

Habitat: Isolated from leaf spots and blotches on *Persea borbonia.*

Type locality: Green Cove Springs, Florida, U.S.A.
Type specimen: FLAS F56789
Type culture: ATCC 201792

Collector: D. Chiappini
Date: October 17, 1997

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The authors thank Judy Mattes for typing the manuscript, Mark A. Garland for rendering the Latin description, Luanne Marsh, Jeffrey W. Lotz for photography and Amie Smith for artwork. Thanks are also extended to Dr. Janice Y. Uchida, Department of Plant Pathology, University of Hawaii at Manoa, for reviewing the manuscript and to professor Pedro W. Crous for his comments and suggestions.

REFERENCES

Boedijn, K. B. and Reitsma, J. 1950. Notes on the genus *Cylindrocladium.* Reinwardtia 1:51-60.

Crous, P. W., Janse, J. H., Victor, D., Marais, G. F. and Alfenas, A. C. 1993. Characterization of some *Cylindrocladium* species with three-septate conidia using morphology, isozyme banding patterns and DNA polymorphisms. Systematic and Applied Microbiology 16:266-273.

Crous, P. W., Korf, A. and van Zyl, W. H. 1995. Nuclear DNA polymorphisms of *Cylindrocladium* species with 1-septate conidia and clavate vesicles. Systematic and Applied Microbiology 18:244-250.

Crous, P. W., Wingfield, M. J. and Alfenas, A. C. 1993. Additions to *Calonectria.* Mycotaxon 46:217-234.

El-Gholl, N. E., Alfenas, A. C., Crous, P. W. and Schubert, T. S. 1993. Description and pathogenicity of *Cylindrocladium ovatum* sp. nov. Canadian Journal of Botany 71:466-470.

Hansen, H. N. and Smith, R. E. 1932. The mechanism of variation in imperfect fungi: *Botrytis cinerea.* Phytopathology 22:953-964.

Munsell Color Company, Inc. 1975. Munsell soil color charts. Baltimore, Maryland.

Peerally, A. 1991. The classification and phytopathology of *Cylindrocladium* species. Mycotaxon 40:323-366.

Peerally, A. 1991. *Cylindrocladium hawksworthii* sp. nov. pathogenic on water-lilies in Mauritius. Mycotaxon 40:367-376.

Snyder, W. C. and Hansen, H. N. 1947. Advantages of natural media and environments in the culture of fungi. Phytopathology 37:420-421.

Sobers, E. K. 1968. Morphology and host range of *Cylindrocladium pteridis.*Phytopathology 58:1265-1270.

Victor, D., Crous, P. W., Janse, J. H. and Wingfield, M. J. 1997. Genetic variation in *Cylindrocladium floridanum* and other morphologically similar *Cylindrocladium* species. Systematic and Applied Microbiology 20:268-285.

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REVISION OF AMANITA ALEXANDRI AND ITS SIMILARITY TO AMANITA POLYPYRAMIS

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Summary

Amanita polypyramis and *Amanita alexandri* are easily confused species of *Amanita* section *Lepidella*. The holotype of the latter taxon was studied, as well as of other collections of the two species. No significant difference between these taxa were found. *Amanita alexandri* is proposed to be a posterior taxonomic synonym of *A. polypyramis.*

Key words: *Amanita alexandri, Amanita polypyramis, Lepidella*, mycoparasites of Agarics.

INTRODUCTION

Amanita polypyramis (Berk. & Curt.) Sacc. and *Amanita alexandri* Guzmán, are two similar species belonging to *Amanita* section *Lepidella*. The species names have been mentioned frequently in the literature, at least for North America.

Agaricus polypyramis Berk. & Curt. was described in 1853, transferred to *Amanita* in 1887 by Saccardo, and has maintained this taxonomic status subsequently.

Amanita alexandri was described as a new species by Guzmán (1975) from the state of Hidalgo, Mexico. The species is presently reported only from three states of Mexico (Durango, Hidalgo and Jalisco). When comparing Guzmán's descriptions (1975, 1980) of *A. alexandri* with those of Bas (1969), Jenkins (1986), Tulloss (1998), and Tulloss *et al.* (1995) for *A. polypyramis,* it is evident that there is similarity in a great number of characters. Based on the literature, the two species can only be separated by the presence, in the first, of spherical to subcylindrical spores, smaller inflated cells in the universal veil material left on the pileus, and a sporocarp with a cheeselike odor.

Following suggestions of Bas (1969) and Jenkins (1986) for the determination of infraspecific ranges in *Amanita*, it was reasonable to consider that *A. alexandri* might be a variety of *A. polypyramis,* rather than an independent species. In view of this situation, it was necessary to study a larger number of morphological characters in *A. alexandri* and to carry out a comparison with these characters in *A. polypyramis*---hoping for a clearer view of their taxonomic relationship.

MATERIALS AND METHODS

Methods and terminology used follow those of Bas (1969), Bas *et al.* (1988), Tulloss *et al.* (1992), and Tulloss (1993, 1994). Macrochemical tests for laccase (syringaldazine) were performed on the holotype of *A. alexandri* (Guzmán 6819, ENCB) and on dried material of *A. polypyramis* (FCME 13436) using small fragments (less than 5 mm in any dimension) of several parts of the sporocarps moistened with distilled water. Laccase test reaction patterns were obtained in fresh and mature samples belonging to *A. polypyramis* following the methodology of Marr *et al.* (1986).

Taxonomic descriptions by Guzmán (1975, 1980) for *A. alexandri* and those by Bas (1969), Jenkins (1986), Tulloss (1998), and Tulloss *et al.* (1995) for *A. polypyramis* were revised. With one exception (RET - Tulloss' personal herbarium), abbreviations of names of herbaria were obtained from Holmgren *et al.* (1990).

Collections examined: A. alexandri: **MEXICO:** HIDALGO, 1 km SW of Huasca, 28.vii.1968, Guzmán 6819 (ENCB), (holotype); Piedra Blanca, 4 km S of Zacualtipán, *s.d.* Varela 259-B (ENCB); Tlalmililolpan km 98, 25.viii.1987 Morales-Torres *s.n.* (FCME 2774 & 2776).
A. polypyramis: **MEXICO**: CHIHUAHUA, Guachochi, km 75 Creel-Guachochi road, 1.5 km after turnoff to La Bufa, 30.viii.1980 Pérez-Silva *s.n.* (MEXU 17677). DURANGO, km 69 Durango-Mazatlán road, 15.viii.1981 Pérez-Silva, Aguirre-Acosta & Chinchilla *s.n.* (MEXU 17806). GUERRERO, Mpio. Taxco de Alarcón, km 0.2 turn off to Cerro del Huizteco, 20.vii.1985 Salomón & Santiago 48 (FCME 13436); Mpio. Chichihualco, "Los Morros", 2.viii.1980 Alpizar-Valfre *s.n.* (FCME 1153). ESTADO DE MEXICO, Mpio. Zinacantepec, road to Parque Estación

Nanchititla [18°53′09"N/100°21′38"W], 7.vii.1997 Morales- Torres 50 (FCME 8951) & Tulloss 7-6-96-A (RET).
Amanita sp., stirps *Chlorinosma:* **MEXICO:** HIDALGO, Mpio. Agua Blanca de Iturbide, Cerro de las Tres Cruces, one side of Agua Blanca town center, 1.x.1996 Morales- Torres 45 (FCME).

Extralimital collections examined: A. polypyramis: **U.S.A.:** FLORIDA, Marion Co. - *ca.* Salt Springs, Ocala Nat. For., 10.xi.1984 A. Norarevian & E.R. Yetter *s.n.* [Tulloss 11-10-84-#1] (RET). MARYLAND, Worcester Co. - Pocomoke R. St. Pk., Milburn Landing, 12.x.1995 L. T. Biechele *s.n.* (RET). NEW JERSEY, Ocean Co. - Waretown, 3.x.1993 C. Hogenbirk 8 (RET). TEXAS, Hardin Co. - Big Thicket Nat. Preserve, Lance Rosier Unit, 24.x.1986 Rosemary Burton *s.n.* [Tulloss 10-25-86-F] (RET); San Augustine Co. - Big Thicket Nat. Preserve, Big Sandy Crk. Unit, 25.x.1986 C.L. Ovrebo *s.n.* [Tulloss 10-25-86-I] (RET). WEST VIRGINIA, Greenbrier Co. - Monongahela Nat. For., Sherwood Lake, R.E. Tulloss 8-31-82-A, M.H. & R.E. Tulloss 9-2-82-C (RET).

RESULTS AND DISCUSSION

MACROSCOPIC CHARACTERS: Neither the revision of the exsiccata nor the comparison of the descriptions of *A. alexandri* and *A. polypyramis* revealed any significant macroscopic differences between the two species. On the contrary, there is a great similarity in numerous characters such as the form, size, and color of the pileus, stipe and bulb; distribution and form of the universal veil; type and ornamentation of the partial veil; and connection of the lamellae to the stipe (Figs. 1, 7, 9 and 10). The only differences were the lamellae of the holotype of *A. alexandri* which were irregular, anastomosed, or with coraloid shape in the dry material and the smell of cheese of the basidioma. Guzmán (1975) discussed the possibility that the strong smell of cheese in *A. alexandri* is due to the presence of yeasts that invaded the lamellae. The presence of yeast-like cells was corroborated in our microscopic revision of the type specimen (Fig. 6). The intrusion by yeasts also might be a cause of the distorted form of the lamellae. In other samples determined as *A. alexandri* (Varela 259 B (ENCB); FCME 2774), a correlation between the cheeselike odor, irregular forms of lamellae, and presence of yeast-like cells is also evident.

In addition, yeast-like cells, the smell of cheese, and distorted lamellae occurred jointly in the mature specimens of a species of *Amanita* stirps *Chlorinosma* (Morales-Torres 45 (FCME)) collected in the same area as one of the paratypes of *A. alexandri* (Gimate 47 (ENCB)) and in one of the sporocarps of Pérez-Silva, Aguirre-Acosta, & Chinchilla *s.n.* (MEXU 17806)---a collection on which was based the first report of *A. polypyramis* from Mexico (Herrera & Pérez-Silva, 1984). In the same two collections, none of the three characteristics were observed in the younger specimens. For these reasons, we considerate that the odor and lamella form of *A. alexandri*, are a response to environmental conditions---probably, infection by an agent or agents including yeasts.

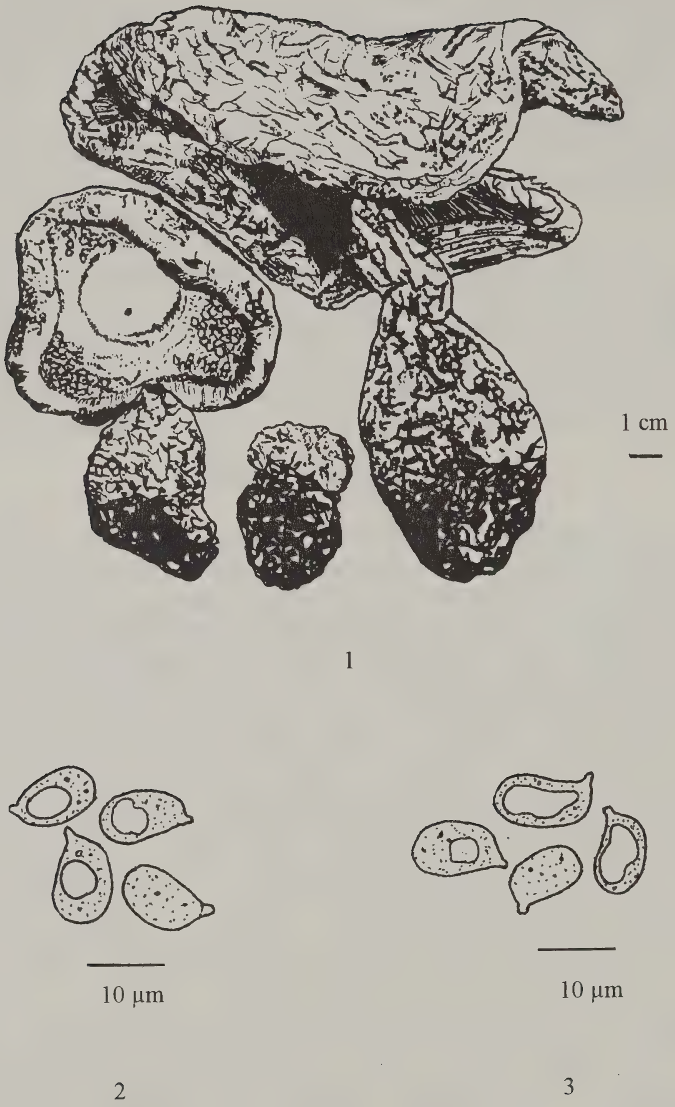
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Fig.1-3 *Amanita alexandri* 1: Dry basidioma. - 2: Basidiospores (*Guzmán 6819* (Holotype), 28.vii.1968). - 3: Basidiospores (*Morales-Torres* (FCME 2774) 25.viii.1987).

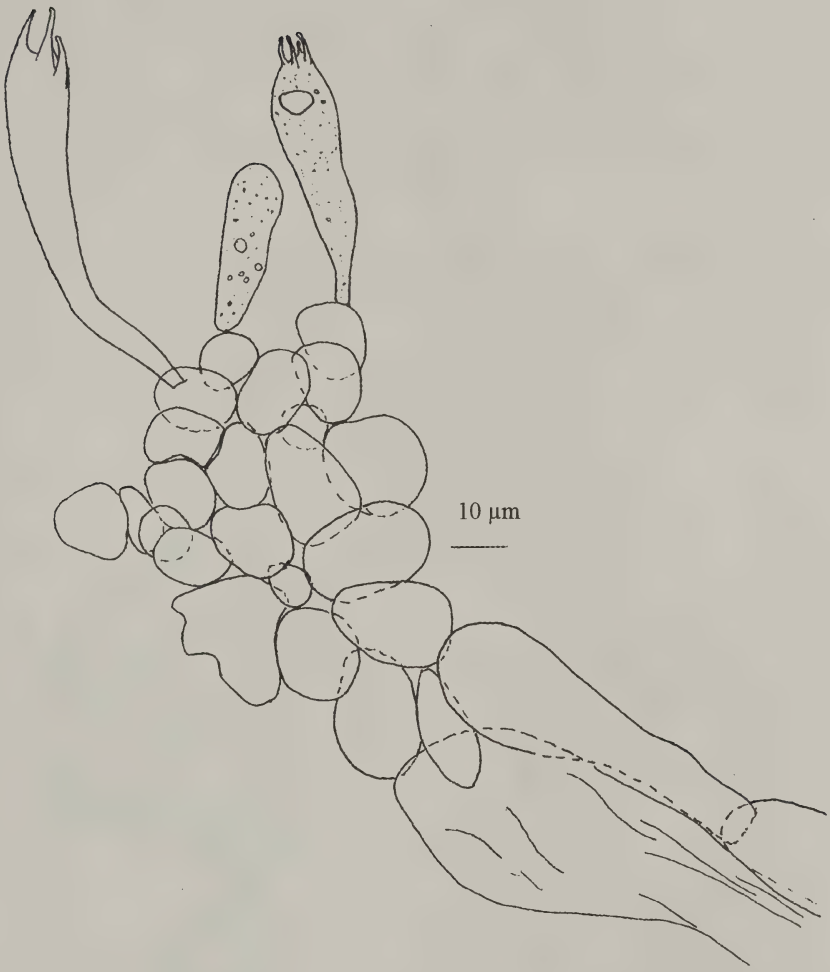
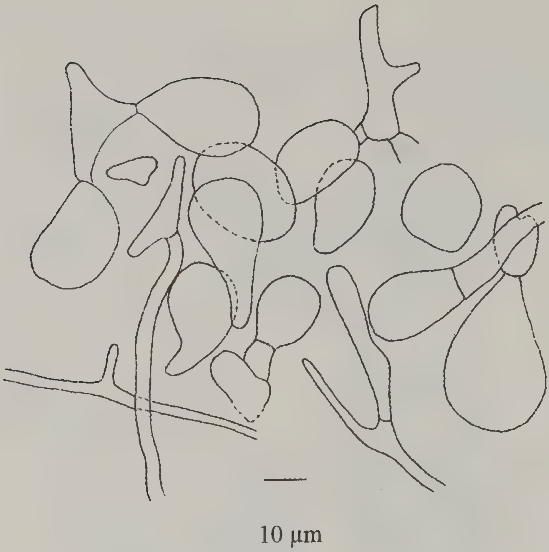


Fig. 4: Elements of hymenium, subhymenium and subhymenial base (*Guzmán 6819* (Holotype), 28.vii.1968).



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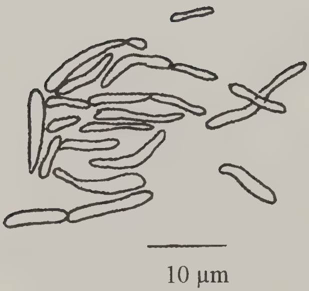

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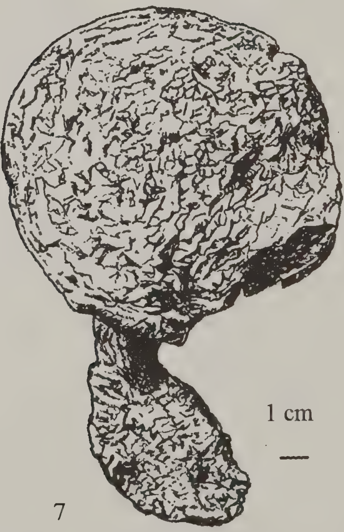

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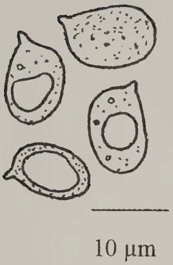
Fig. 5-6. *Amanita alexandri*. 5: Elements of universal veil on pileus. - 6: Yeast-like cells in sporocarp. (*Guzmán 6819* (Holotype), 28.vii.1968). - 7: *Amanita polypyramis*: Dry basidioma. (*Pérez-Silva, Aguirre-Acosta* & *Chinchilla* (MEXU 17806), 15.viii.1981).

MACROCHEMICAL TESTS: Spot testing for laccase in mature and fresh samples of *A. polypyramis* from the eastern U.S.A. (Tulloss 10-25-86-F; 10-25-86-I) is immediately positive in large areas of the middle part of the stipe and of the base of the bulb (Tulloss, unpub. data). The same reaction was observed in Mexican material of this species [Morales-Torres 50 (FCME 8951)]. Even though Harkin *et al.* (1974) note that the syringaldazine spot test for laccase can yield inconstant results when employed on dry material, such tests carried out on dry material of *A. polypyramis* [Salomón and Santiago 48 (FCME 13436)] and *A. alexandri* (holotype) produced similar reaction patterns to those seen in fresh material of *A. polypyramis*, although of much lower intensity. Syringaldazine spot test results are summarized in the Table 1.

MICROSCOPIC CHARACTERS: BASIDIOSPORES: Although according to the original description of *A. alexandri* and the different revisions of *A. polypyramis,* spores are of different form and size in the two species, re-examination of the holotype of *A. alexandri*, together with revision of other collections of both species, revealed that there are no significant differences between spores of the species. The form of the spores in both species is ellipsoid to elongate, and their content is always subgranular to guttulate, (Figs. 2, 3, 8, 11 and 13). In Table 2 other characteristics of the spores are compared for diverse collections of the species studied. BASIDIA: New dimension data were obtained from revision of the holotype of *A. alexandri*. These data (49.5 - 61.0 X 9.0 - 12.5 µm) show the sizes of basidia to be quite similar in the two species. Some other characters of the 4-sterigmate basidia are also very similar in all the revised material; for example, the basidia lack basal clamps and have sterigmata up to 5 µm long (Figs. 4, 12 and 14). MARGINAL TISSUE OF LAMELLAE: Revision of the holotype of *A. alexandri* demonstrated that the cellular morphology is essentially the same as that in *A. polypyramis*---comprising ovoid to ellipsoid cells forming short chains, interwoven with clavate and scarce elongate to semiclavate cells. Unfortunately, many cells were impossible to rehydrate completely (possibly due to damage caused by the great quantity of surrounding yeasts); and only some cells could be measured. The measured cells were slightly smaller (21 - 34 µm) than those of *A. polypyramis* (30 - 45 µm). SUBHYMENIUM: In the holotype of *A. alexandri* and other revised collections, this tissue is anatomically similar to the subhymenium of *A. polypyramis*---subcellular to inflated-ramose (Figs. 4, 12 and 14). CENTRAL STRATUM: This tissue could not be observed in the type specimen of *A. alexandri* because of rehydration problems. PILEIPELLIS: In the holotype of *A. alexandri*, this tissue has two well-differentiated layers---a gelatinized suprapellis and a subpellis with interwoven, branching hyphae 3.9 - 7.8 µm wide, without clamp connections, and scarce vascular hyphae. The structure and composition coincide with those reported for *A. polypyramis* by Bas (1969) and Jenkins (1986). UNIVERSAL VEIL: *On pileus:* The cellular morphology is similar in the two species, in as much as both present ellipsoid, ovoid, slenderly clavate, irregular, subcylindrical, elongate, and coraloid cells terminal singly or forming short terminal chains (Figs. 5 and 15). Furthermore, in holotype of *A. alexandri*, scarce subcylindrical to elongate cells (up to 196 X 60 µm) were found closely attached to the pileipellis and hindering its localization. These cells are

Table 1. - Syringaldazine spot tests for laccase in dry material assigned to *A. alexandri* and *A. polypyramis*.

	Amanita alexandri Holotype Guzmán 6819 (ENCB)	*Amanita polypyramis* FCME 13436
Stipe		
Context	+ Very weak	+ Very weak
Stipepellis	+ Very weak	+ Very weak
Gills	- Without reaction	- Without reaction



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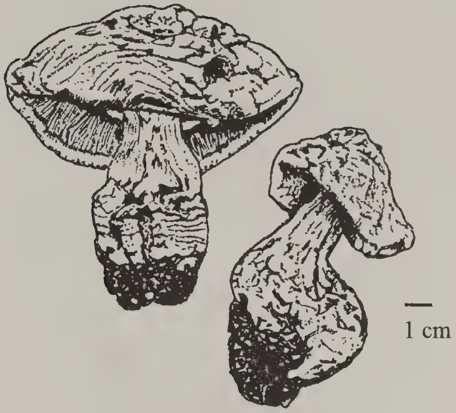

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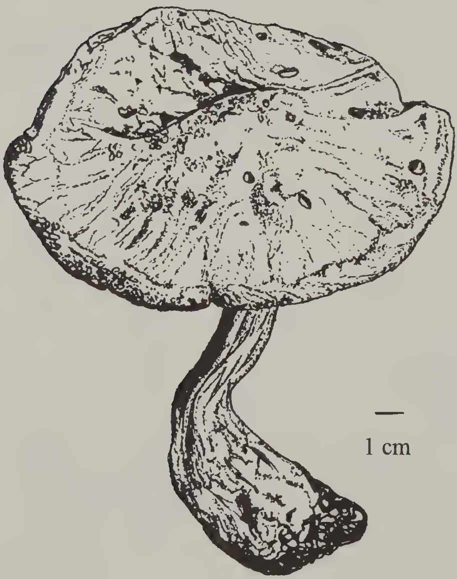

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Fig. 8-10. *Amanita polypyramis*. 8: Basidiospores (*Pérez-Silva* (MEXU 17677), 30.viii.1980). 9: Dry basidioma (*Pérez-Silva*, *Aguirre-Acosta* & *Chinchilla* (MEXU 17806), 15.viii.1981). 10: Dry basidioma (*Salomón* & *Santiago 48* (FCME 13436), 20.vii.1985).

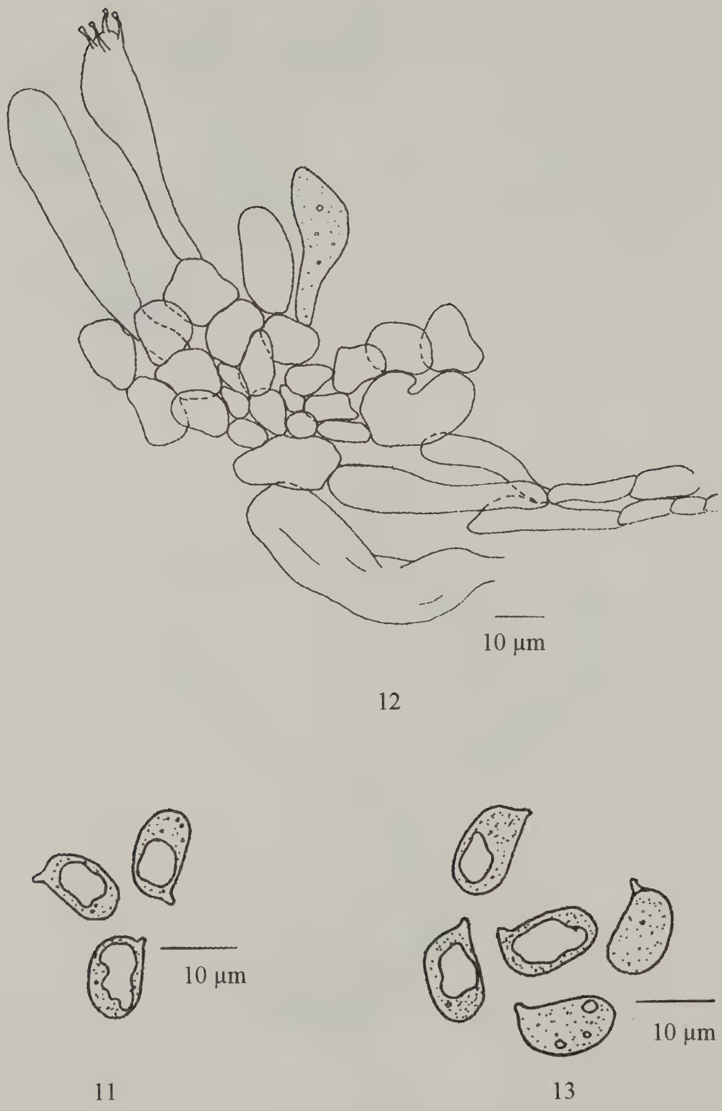
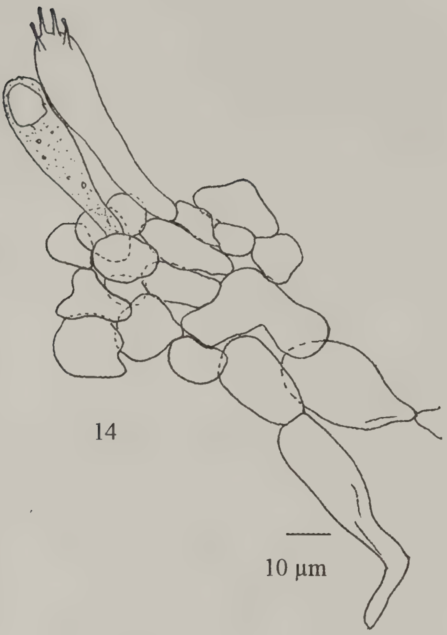


Fig. 11-13. *Amanita polypyramis*. 11: Basidiospores. - 12: Elements of hymenium, subhymenium and subhymenial base (*Salomón & Santiago 48* (FCME 13436), 20.vii.1985). - 13: Basidiospores (*Morales-Torres 50* (FCME 8951), 7.vii.1997).



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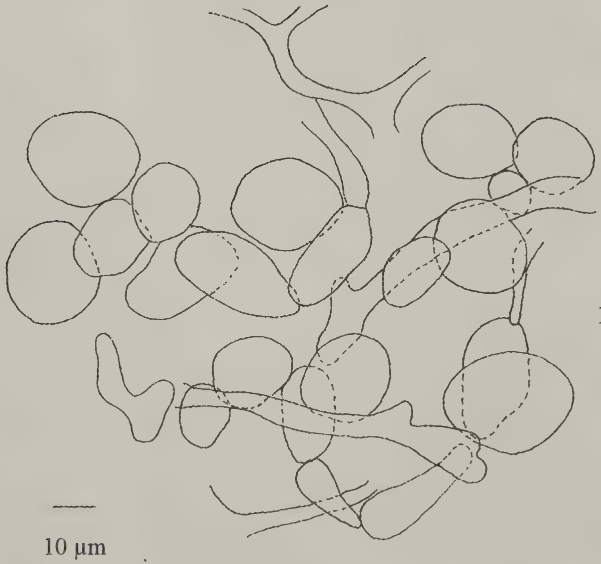

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Fig. 14-15. *Amanita polypyramis*. 14: Elements of hymenium, subhymenium and subhymenial base. - 15: Elements of universal veil on pileus (*Morales-Torres 50* (FCME 8951), 7.vii.1997).

Table 2. Characteristics of spores of several collections of *A. alexandri* and *A. polypyramis.*

Species	Size of spores	Q	Q'
A. alexandri * Holotype (ENCB) Guzmán 6819 HIDALGO, MEXICO	(8.5-) 9.1 - 13.0 (-16.0) X (5.5-) 6.5 - 8.5 (-9.0)µm	(1.3-)1.4-1.8(-2.0)	1.60
A. alexandri * Varela 259B (ENCB) HIDALGO, MEXICO	(7.2-) 9.1 - 13.0 X 5.2 - 6.5 (-7.2)µm	1.3 - 2.0	1.80
A. alexandri * (FCME 2774) HIDALGO, MEXICO	9.1 - 12.0 (-13.0) X 5.6 - 7.0 µm	1.4 - 1.8 (-2.0)	1.60
A. polypyramis Bas (1969) USA	(9.5 -) 10.0 - 13.0 X 5.6 - 7.0 µm	(1.2-) 1.5 - 1.95	Not described
A. polypyramis Jenkins (1986) USA	9.2 - 13.6 X 5.5 - 9.5 µm	1.25 - 1.89	1.69
A. polypyramis ** Tulloss 8-31-82A WEST VIRGINIA USA	(7.7-) 9.1 - 10.8 (-11.5) X (5.2-) 6.3 - 7.7 µm	(1.27-) 1.36 - 1.68 (-1.74)	1.50
A. polypyramis ** Tulloss 9-2-82-C WEST VIRGINIA USA	(7.0-) 8.4 - 10.1 X 5.9 - 7.0 (-7.3)µm	(1.11-) 1.21 - 1.54 (-1.71)	1.35
A. polypyramis ** Tulloss 11-10-84#1 FLORIDA USA	(9.8-) 10.5 - 12.6 (-13.3)X (5.6-) 5.9 - 7.0 (-8.0)µm	1.56 - 1.94 (2.02)	1.78

* Collections with cheeselike odor and yeast-shaped cells in the hymenium.
** Unpublished data (Tulloss).

Table 2 (continuation)

Species	Size of spores	Q	Q'
A. polypyramis ** Hogenbirk(3.x.1993) NEW JERSEY USA	(10.0-) 11.0-13.5 (-17.5) X 6.0 - 7.0 (-9.5)µm	(1.62-) 1.64 - 2.0 (-2.02)	1.81
A. polypyramis ** Biechele(12.x.1995) MARYLAND USA	(9.5-) 10.0 - 12.3 (-12.6)X 5.4 - 7.5 (-8.9)µm	(1.38-) 1.40 - 1.97 (-2.0)	1.66
A. polypyramis ** Tulloss 7-6-96-A ESTADO DE MEXICO MEXICO	(10.4-) 11.6-12.5 (-13.0)X (6.3-) 6.5 - 7.7 (-8.0)µm	(1.47-)1.48 - 1.73 (-1.77)	1.61
A. polypyramis (FCME 1153) GUERRERO MEXICO	(10.5-) 10.8-12.5 (-14.5)x 6.5 - 8.5 (-9.0)µm	1.35 - 1.72 (-1.81)	1.56
A. polypyramis (FCME 13436) GUERRERO MEXICO	(9.1-) 9.8 - 12.0 (-13.0)X (5.2-) 6.0 - 8.0 µm	(1.4-) 1.5 - 1.8	1.60
A. polypyramis (FCME 8951) ESTADO DE MEXICO MEXICO	9.1 - 12.0 X 5.2 - 6.5 µm	1.4 - 1.8 (-2.0)	1.60
A. polypyramis *** (MEXU 17677) CHIHUAHUA MEXICO	9.8 - 12.6 X 7.0 - 8.4 µm	(1.3-) 1.36 - 1.63 (-1.7)	1.50
A. polypyramis *** (MEXU 17806) DURANGO MEXICO	(9.0-) 10.5 - 12.6 (-13.3)X 6.3 - 8.4 µm	(1.4-) 1.45 - 1.8	1.60

** Unpublished data (Tulloss).

*** Collections used in the first report of *A. polypyramis* for Mexico by Herrera and Pérez-Silva (1984).

unusual in *Amanita* subsection *Solitariae* and are nearly identical to cells similarly located in *A. polypyramis* according to Bas (1969). *On stipe base:* in the holotype of *A. alexandri* the cells comprising this tissue were invaded by yeast-shaped cells, similar to the ones in the hymenium. Nevertheless, it was not possible to detect differences between the cellular structure described for *A. polypyramis* and the one observed in *A. alexandri.* STIPE CONTEXT: For *A. polypyramis,* the longitudinally acrophysalidic tissue is composed of clavate cells that are terminal singly or in short chains interwoven with sometimes abundant filamentous hyphae 4 - 10 µm wide, and oleiferous hyphae. The tissue is nearly identical in the holotype of *A. alexandri*, even with regard to the oleiferous hyphae.

CONCLUSIONS

Based on the literature as well as observations of fresh and dried material, it is not possible to find significant morphological differences between *A. alexandri* and *A. polypyramis.* We propose that the observed differences between the taxa are the result of the action of an organism or organisms that sometimes invade mature basidioma of *A. polypyramis*. We propose that *A. alexandri* be considered a posterior taxonomic synonym of *A. polypyramis.*

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We are grateful to Dr. Teófilo Herrera, Dr. Arturo Estrada Torres and M. Sc. Guadalupe Santiago Martínez for their critical presubmission reviews and suggestions on this manuscript. We extend thanks to M. Sc. Ricardo Valenzuela (ENCB) and M. Sc. Elvira Aguirre (MEXU) who made possible loans of herbarium specimens from their respective institutions. Morales-Torres, Villegas-Ríos and Cifuentes are grateful for the partial financial support provided by PAEP project 002005, DGAPA projects IN203895 and IN217198, and CONACYT project PN-0090.

LITERATURE CITED

Bas, C. 1969. Morphology and subdivision of *Amanita* and a monograph of its section *Lepidella. Persoonia* 5: 285 - 579.

_____, Th. W. Kuyper, M. E. Noordeloos, and E. C. Vellinga. 1988. *Flora Agaricina Neerlandica.* Balkema, Rotterdain.

Guzmán, G. 1975. New and interesting species of Agaricales in México. *Studies on the Higher Fungi.* H Bigelow & H. D. Thiers, ed. *Beih. Nova Hedwigia* 51: 99-118.

_____. 1980. *Identificación de los hongos.* Limusa, México, D.F.

Harkin, J.M., Larsen, M.J., and Obst, J.R. 1974. Use of syringaldazine for detection of laccase in sporophores of wood rotting fungi. *Mycologia* 66 (3): 469 - 476.

Herrera, T., Pérez-Silva, E. 1984. Descripción de algunas especies del género *Amanita. Bol. Soc. Méx. Micol.* 19: 265 - 273.

Holmgren, P.K., N.H. Holmgren, and L.C. Barnett. 1990. *Index herbariorum. Part I. The herbaria of tbe world.* 8th ed. *Regnum Veg.* 120: 1-693.

Jenkins, D. T. 1986. *Amanita of North America.* Mad River, Eureka, California.

Marr, C. D., D. W. Grund and K. A. Harrison. 1986. The taxonomic potential of laccase and tyrosinase spot test. *Mycologia* 78: 169-184.

Tulloss, R. E. 1993. *Amanita pachysperma, Amanita subvirginiana,* and *Amanita virginiana* (taxonomy and distribution) with notes on description of the lamella trama in *Amanita. Mycotaxon* 49: 449-475.

_____. 1994. Type studies in *Amanita* section *Vaginatae* I: Some taxa described in this Century (studies 1-23) with notes on description of spores and refractive hyphae in *Amanita. Mycotaxon* 52: 305-396.

_____. 1998. *Seminar on Amanita.* 4th ed., NAMA98 & Mycol. Soc. San Francisco, USA.

_____, C. L. Ovrebo, and R. E. Halling. 1992. Studies on *Amanita* (Agaricales) from Andean Colombia. *Mem. New York Bot. Gard* 66: 1-46.

_____, S. L. Stephenson, R. P. Bhatt, and A. Kumar. 1995. Studies on *Amanita* (Amanitaceae) in West Virginia and adjacent areas of the mid-Appalachians. Preliminary results. *Mycotaxon* 56: 243-293.

MYCOTAXON

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PEZOLOMA KATHIAE SP. NOV. (ASCOMYCETES: LEOTIALES, LEOTIACEAE), AND ITS PLACEMENT IN A NEW SUBGENUS, PHAEOPEZOLOMA

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In a recent paper (Lizon & al., 1998) the genus *Pezoloma* Clem. has been referred to the family Leotiaceae *sensu stricto,* along with three other genera, *Leotia* Pers., *Geocoryne* Korf, and *Neobulgaria* Petrak. Two other genera, now assigned to the Calloriopsidae Pfister, *Calloriopsis* Syd. & P. Syd. and *Gelatinopsis* Rambold & Triebel, may also belong in that family, as may *Gelatinipulvinella* Hosoya & Y. Otani. These genera are the only ones I currently recognize in the Leotiales *sensu stricto.* Other discomycetes previously treated in the Leotiaceae *sensu lato* by workers who followed Korf (1973) are once again to be referred to the Helotiaceae Rehm, *nom. conserv.* (conserved by the 1999 International Botanical Congress), and to the Helotiales.

A remarkable fungus was discovered on water-soaked wood in New York State in 1997 by one of my students, Ms. Kathie Hodge, and brought to my attention. To the naked eye it greatly resembles a species of *Vibrissea* Fr. sect. *Apostemium* P. Karst. in size, color, and habitat. The small apothecia (up to 1.5 mm diam) are about as tall as they are wide, distinctly turbinate, with a convex, yellowish hymenium, and with a broadly attached, tapering base. In some specimens the base is short-stipitate, recalling *Pezoloma iodopedis* Korf, Lizon, & Iturr. (Lizon & al., 1998). Though the upper flanks of the apothecium are more or less concolorous with the disc, at full maturity the basal parts appear to be almost woolly and dark brown or nearly black. A section of the apothecium (FIG. 1) reveals

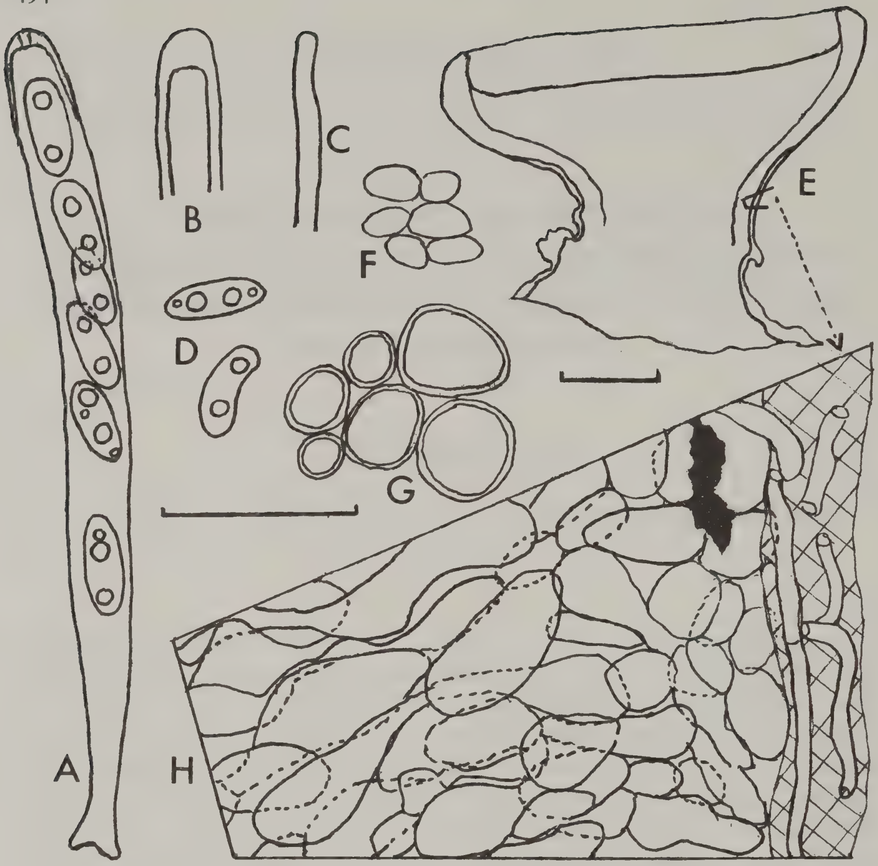

FIG. 1. *Pezoloma kathiae,* line drawings made with the aid of a drawing tube. A. Six-spored mature ascus showing apical pore. B. Apex of immature ascus with thick walls (prior to pore appearance). C. Paraphysis apex. D. 2 discharged ascospores. E. Vertical section of apothecium. F. 6 subhyaline marginal cells. G. 6 thicker-walled brown basal inner ectal excipular cells. H. Enlarged portion of the lower flank tissues showing—from left to right—inner ectal excipulum of hyaline non-gelatinized textura intricata/textura sub-globulosa/textura angularis and (in black) a refringent crystalline inclusion, and outer ectal excipulum of a few layers of hyphae immersed in copious gel (shown cross-hatched) which turns light blue in Melzer's Reagent. A-D, and F-H use long scale bar = 20μm, E uses short scale bar = 200μm. A-D, CUP *65354,* mounted in water, *paratype,* E-H, CUP *65322,* mounted in lactophenol/cotton blue, *holotype.*

that the structure is clearly that of the genus *Pezoloma:* there is a limited basal gel pad which extends only part-way up the flanks of the apothecium forming the outer ectal excipulum, consisting of more or less parallel hyphae in a gel. Some subhyaline to dark brown hyphae protrude from the gel and give the basal woolly appearance. Inside this gel layer and extending upwards beyond it to the margin is the layer we term the inner ectal excipulum, consisting of large, thin-walled, more or less isodiametric cells without any trace of gel. Marginal cells of the inner ectal layer are much smaller than more basal cells of this layer. The medullary tissues are composed of hyaline, interwoven hyphae immersed in a gel, as in other species of the genus. The terminal and subterminal cells of these hyphae are often markedly clavate, particularly as they approach the inner ectal excipulum; these clavate elements eventually differentiate into the large, more-or-less isodiametric cells that form that layer. Such clavate elements have not been reported in this genus before, though they are illustrated without comment in the paper describing *Pezoloma iodocyanescens* (Dennis & Korf) Korf (see Dennis & Korf, 1958, as *Sphagnicola iodocyanscens* Dennis & Korf).

Unlike most species of *Pezoloma* previously described, this fungus has distinctly brown cell walls in the outermost layer of the inner ectal excipulum near the base, and such brown cell walls are evident part way up the flanks in mature apothecia, becoming hyaline only as they approach the margin or the inner portions of the apothecium. In only one other species, *P. iodocyanescens* mentioned above, have any darkened cell walls previously been noted in the genus.

These two fungi thus appear to differ from other species referred to *Pezoloma.* Rather then erecting a new genus to accommodate them, I prefer to treat both as members of that genus, and propose a new subgenus, *Pezoloma* subg. *Phaeopezoloma,* for them, typified by the new species, *P. kathiae.* All other known species of the genus should be referred to *Pezoloma* Clem. subg. *Pezoloma.*

PEZOLOMA Clem. subg. **PHAEOPEZOLOMA** Korf, *subg. nov.*

Pezoloma *similis, sed cellulis ectale brunneis. Holotypus:* Pezoloma kathiae *Korf.*

Pezoloma kathiae Korf, sp. nov. [FIG. 1]

Pezolomati iodocyanescenti simile, ascosporis et ascis minoribus et substrato differens.

Apothecia scattered on water-soaked wood in a stream, distinctly turbinate, 1.2–1.5 mm diam at maturity, height including stipe equal to or less than diam of disc. *Hymenium* at first pale ivory, then greyish yellow to wax yellow to mustard yellow (Koernerup & Wanscher 2B6 to 3B5 or 3B6), when older darker, brass (K&W 4C7). Receptacle concolorous with hymenium at the margin, blackish-punctate toward the black base. *Stipe* appearing almost woolly with a basal *gel pad* covering the stipe and running up the flanks of the receptacle about half-way to the margin, forming the outer ectal excipulum. In section: *outer ectal excipulum* of one to four layers of straight to somewhat undulate but not coiled hyphae, gel pale grey-blue in Melzer's Reagent, with some subhyaline to dark brown hyphae protruding from the gel; *inner ectal excipulum* basally of large, brown-walled ± spherical cells, as in Mollisiaceae and Vibrisseaceae, but hyaline toward the inside and toward the margin, sometimes forming wart-like protuberances near the stipe base. *Medullary excipulum* of textura intricata in a gel, consisting of hyaline, distantly septate hyphae of various widths, 2.5–4.6 (–6.2) µm wide, with clavate to obpyriform cells toward the ectal excipulum which eventually grade out to form the inner ectal excipulum as in *P. iodocyanescens*. Refractive, irregularly shaped *crystalline bodies* scattered irregularly throughout the medullary and inner ectal excipulum, 3.8–11 (–28) µm in diam. *Subhymenium* indistinguishable from medullary excipulum. *Asci* typically 8-spored, but sometimes fewer-spored, occasionally even 1- or 2-spored, arising from obvious croziers, dextrinoid during development, 80–90 x 6.2–7.7 µm, with a J+ apical pore even without KOH-pretreatment (but the blue reaction enhanced by pretreatment in 3% aqueous KOH), young asci thick-walled, with a very thickened apex. *Ascospores* hyaline, with 2–3 large guttules and often with 1 or 2 smaller guttules, sometimes curved, typically biseriate in living asci, uniseriate in dead asci, 10–16 x 3.1–3.5 µm. *Paraphyses* multiguttulate when living and mounted in water, guttules disappearing when dead and in KOH mounts, unbranched, apex rounded, ca. 2.0 µm in diam, septa rare.

Etymology: named for my former student, and now my successor at Cornell University, Kathie Hodge.

Holotype: On water-soaked wood in the outlet stream, S. end (Stage 1) of Hendershot Gulf (the Lost Gorge), SE of Alpine, NY, leg. Kathie Hodge, 8. x. 1997, CUP 65322.

Paratype: On very wet wood in the outlet stream, S. end (Stage 1) of Hendershot Gulf (the Lost Gorge), SE of Alpine, NY, leg. R. P. Korf, 7. x. 1998, CUP 65354 (duplicate in pers. herbarium of H.-O. Baral).

Cultures: Ascospores were isolated from the type collection by Kathie Hodge; these germinated and yielded a mycelium with no apparent conidial anamorph. A culture has been deposited in the American Type Culture Collection under the accession number ATCC 204366.

Notes: A colleague, Hans-Otto Baral, has been in correspondence with me about the placement of this species and others now ranged in *Pezoloma.* He has offered the interesting observation that specimens he has identified as *Hymenoscyphus imberbis* (Bull.) Dennis and at least one species described as a member of *Phaeohelotium* Kanouse may also have a basal gel pad, blueing as it does in both species of *Pezoloma* subg. *Pezoloma* and in *P. iodopedis.* This raises the question of whether such species should be treated instead in *Pezoloma.* Medullary gel tissues of the sort found in *Pezoloma* would surely be quite unexpected in either *Hymenoscyphus* (Nees) Gray or *Phaeohelotium.* His research is in progress.

Acknowledgements

I thank Kathie Hodge for collecting the type specimen, for calling it to my attention, and for culturing it for deposit in ATCC. Emeritus Professor William Dress, Cornell University, kindly corrected my Latin diagnosis of the new species. H.-O. Baral, Tübingen, Germany, is thanked for his always stimulating observations and advice.

Literature Cited

Dennis, R. W. G., and R. P. Korf. 1958. A Japanese species of *Sphagnicola* Velenovsky. *Kew Bull.* 1958: 181-183.

Korf, R. P. 1973. Chapter 9. Discomycetes and Tuberales, pp. 249-319 *in* G. C. Ainsworth, F. K. Sparrow, & A. S. Sussman [eds.], *The Fungi, an Advanced Treatise, Volume IVA. A Taxonomic Review with Keys: Ascomycetes and Fungi Imperfecti.* New York, Academic Press.

Kornerup, A., & J. H. Wanscher. 1967. *Methuen Handbook of Color,* 2nd. ed. London, Methuen.

Lizoň, P., T. Iturriaga, & R. P. Korf. 1998. A preliminary discomycete flora of Macaronesia: part 18, Leotiales. *Mycotaxon* 68: 73-83.

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ONLINE RESOURCES FOR FUNGAL TAXONOMY & NOMENCLATURE: ONLINE DATABASES

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http://biodiversity.uno.edu/~fungi/

Mycological web sites are useful sources of mushroom recipes, fungus-inspired poetry, fungal images, phylogenetic trees, cultivation tips, taxonomic data. The sleekest of sites are some of the larger, searchable databases that are critical resources in the practice of modern mycology. A handful of these are discussed below.

Online indices

GenBank is a behemoth among online databases — a repository of DNA sequence information offered by the US National Center for Biotechnology Information. The entire genome of Saccharomyces cerevisiae is available, for example, and NCBI provides powerful tools for investigating all this data: a taxon browser, a tool for sequence comparisons (BLAST), and a database of 3-dimensional protein structures.

GENBANK	http://www.ncbi.nlm.nih.gov/

Within mycology, the among the most useful of online databases are simple address directories such as these:

MYCOLOGISTS ONLINE	gopher://biodiversity.uno.edu:70/11/directories/mo (last version at http://web.savba.sk/botu/myco/default.asp)
LICHENOLOGISTS' AND MYCOLOGISTS' E-MAIL ADDRESS LIST	http://www.botanik.biologie.uni-muenchen.de/botsamml/lias/emaillist.html
INTERNATIONAL ASSOCIATION OF LICHENOLOGISTS DIRECTORY	http://www.botany.hawaii.edu/lichen/

Fungal taxonomists benefit greatly from online indices to important works like Saccardo's Sylloge Fungorum, the Index of Fungi, and Farr et al.'s host index, Fungi on Plants and Plant Products in the US. The latter are all available through the web site of the Systematic Botany and Mycology Lab in Beltsville, Maryland. Nomenclatural information for generic names is provided by Index Nominum Genericorum (Plantarum). Online nomenclatural databases at the Centraalbureau voor Schimmelcultures cover the Aphyllophorales and Fusarium; C. Shearer provides a synopsis of freshwater ascomycetes; and B. Hein provides a nomenclator of the Dermateaceae.

DATABASES AT SBML	http://NT.ars-grin.gov/fungaldatabases/
INDEX NOMINUM GENERICORUM	http://www.nmnh.si.edu/ing/
APHYLLOPHORALES	http://www.cbs.knaw.nl/aphyllo/database.html

FUSARIUM	http://www.cbs.knaw.nl/fusarium/database.html
FRESHWATER ASCOMYCETES AND THEIR ANAMORPHS	http://www.life.uiuc.edu/plantbio/fungi/
DERMBASE: NAMES OF DERMATEACEAE	http://www.Bgbm.fu-berlin.de/BGBM/RESEARCH/DATA/dermatea/default.HTM

The latter nomenclatural databases are under development, and input is invited to flesh them out. In this aspect they approach the category of databases I wish to introduce next, which are compiled by communal effort.

Contributed databases

At least two brave sites rely on the input of the mycological community to build a resource. Anateleo is a database of anamorph-teleomorph connections that is developing under the direction of J. Brzustowski. C. B. Samuels, developer of the commercial software Discover Mushrooms, is working on a public domain database of agarics based on input from volunteer contributors. The success and utility of these sites depends on your input:

ANATELEO	http://gause.biology.ualberta.ca/jbrzusto/anateleo/anatel.html
MUSHROOM DATABASE	http://www.mushroom.cc/database.htm

What's next

Not yet widely seen in mycological circles, distributed databases offer the potential to search seamlessly across multiple sites from a single search interface. Such resources could be greatly facilitated by XML (eXtensible Markup Language) which provides a common data format for information exchange. XML is a close cousin of HTML (Hypertext Markup Language, of which web pages are made), and provides simple "tags" or identifiers by which categories of data can be recognized, even outside of their normal context. A present shortcoming of XML is the limited vocabulary of tag names —I would be surprised if the developers have yet invented a tag that can be universally interpreted to mean "anamorph."

ANNOTATED XML SPECIFICATION	http://www.xml.com/pub/axml/axmlintro.html

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BOOK REVIEWS

Eric H.C. McKenzie, Book Review Editor

Fungi of Northern Europe. Vol. 2. The genus **Lactarius** by Jacob Heilmann-Clausen, Annemeike Verbeken, and Jan Vesterholt (1998). 287 pp., 230 x 165 mm. The Danish Mycological Society, Mundelstrup. Orders: Svampetryk, Kornblomstvej 6, DK-8381 Mundelstrup, Denmark. ISBN 87-983581-4-6. Dkr 250 + postage.

This second volume in the series covers one of the more recognizable and commonly collected genera of fleshy fungi, *Lactarius*, and represents several years of cooperation between a Belgian mycologist, two Danish mycologists, andthe Finnish mycological group. As a result, it blends the traditions of Nordic mycology laid down by E. M. Fries, P. A. Karsten, and J. E. Lange as well as those of central Europe represented by J. B. F. Bulliard, L. Quélet, and H. Romagnesi. The result is a well-warranted and comprehensive work on a fascinating but difficult genus.

After a brief, informative introduction, the value and importance of macroscopic and microscopic characters in the identification of taxa are described. The discussion of these features is accompanied by colour photographs of the latex, including colour changes on exposure to air, and scrobiculations on the stipe and cap as well as line drawings of basidiospore ornamentation, hyphal organization in the gill trama and hymenium, and pileipellis structure. This is followed by a brief outline of the infrageneric classification utilized by the authors along with comments on the ecology of *Lactarius* and notes on edible and poisonous taxa.

Each of the 97 species recognized by the authors from northern Europe is described in detail along with one or more colour photographs accompanied by detailed line drawings. This volume is formatted with descriptions in the left facing page and photographs and line drawings on the right hand page. Beneath the specific epithets are listed the basionym, most important synonyms, misinterpretations, notations on the type, and an italicized summary of the diagnostic characters of each taxon. These treatments are invaluable and reflect the scholarly nature of the publication. This is followed by comprehensive descriptions which include important ecological and geographical data and are based almost exclusively on fresh specimens collected from different locations throughout northern Europe that were studied by the authors. The discussions, although informative, may be too brief for the professional mycologist truly interested in the northern European concept of taxa which might also occur in other northern latitudes around the world.

The series is designed to be comprehensive which means that all species, regardless of size or difficulty in identification, are included. Necessarily this means resorting to a microscope, although plain language is used wherever possible, and macroscopic features are used as much as practical. Although the Keys to Species are based largely on macroscopic characters, they include microscopic characters which some readers may find frustrating if they don't have a microscope. I was able to follow the keys readily as they seemed to be tried and true, authoritative keys based on original observations.

A list of the collections studied and illustrated is included as an appendix at the end of the text followed by 'Colour References' compiled by the authors, which refer to colour annotations and alphanumeric notations in Kornerup & Wanscher. This volume concludes with data on the geographical distribution of each taxon, based on published literature reports listed by the authors, a detailed list of literature on *Lactarius* in northern Europe, and a convenient index. The fact that the authors took the time to account for literature published by others, names in that literature, and confusion or resolution which results from the cited articles, speaks to the high quality of the work contained in this volume.

This book, and the series in general, are recommended for the serious amateur and all professional agaricologists as standard references and identification tools for all fungi from the northern latitudes.

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Genera of **Bionectriaceae, Hypocreaceae** *and* **Nectriaceae (Hypocreales, Ascomycetes)** by A.Y. Rossman, G.J. Samuels, C.T. Rogerson and R. Lowen (1999). 248 pp, 295 x 210 mm. *Studies in Mycology 42*. Available from CBS, Baarn/Delft, The Netherlands. ISBN 90-70351-38-2. Hfl. 95 + postage.

After many years of dedicated hard work, pounding away at the keyboard, rummaging through old dusty books in the library, and fighting off leaches and mosquitoes in the tropics, the long awaited Genera of *Hypocreales* has finally been published! One of the reasons why this is such an exciting book, is that the *Hypocreales* represents an order of ascomycetes that includes numerous species that play a role as plant pathogens, producers of secondary metabolites, or as agents of biological control.

I have decided to structure this review as follows: firstly I will deal with the contents of the book itself in brief, and secondly discuss what I perceive to be its major strengths and weaknesses. Three families are recognized, the *Bionectriaceae*, *Hypocreaceae* and the *Nectriaceae*, incorporating 56 teleomorph genera (six newly described), and also listing the anamorph relationships where known. Keys are also provided to the families, including the *Niessliaceae* and *Clavicipitaceae*, which are not dealt with here. A methods section that discusses techniques used to study herbarium specimens and cultures follows a brief introduction. A section is also devoted to a general discussion of the morphological and biological characteristics observed while studying members of the three families. Each genus listed is fully circumscribed, illustrated, and discussed. In most cases keys are also provided to species of genera that have recently been treated. The *Bionectriaceae*, a new family, is represented by 26 genera, with acremonium-like anamorphs. One new genus, *Ochronectria*, and numerous new combinations and species are proposed in this family. The *Hypocreaceae* is represented by 12 genera, with most species belonging to either *Hypocrea* (mostly with *Trichoderma* anamorphs) or *Hypomyces* (various anamorphs). This treatment lists the various genera and lays a solid foundation for the family, also referring in several instances to holistic treatments presently underway in e.g., *Hypocrea* and *Hypomyces*, pending new morphological, ecological, and molecular data. Twenty genera are dealt with in the *Nectriaceae*. Five new genera are introduced, namely *Albonectria*, *Haematonectria*, *Lanatonectria*, *Rubrinectria*, and *Viridispora*. Not all the anamorphs are named, and many are just named at generic level. This reflects the confusion that has arisen because of the polyphyletic nature of some anamorph genera (e.g., *Fusarium*). Undoubtedly some of these anamorphs only resemble *Fusarium* in form, and would be better referred to as fusarium-like, until molecular data justifies them being described as a different genus, to also coincide with their different teleomorphs. Several genera are treated but still remain heterogeneous, for instance *Cosmospora*, which has *Chaetopsina* and *Cylindrocladiella* anamorphs, as well as some that are acremonium-like and fusarium-like. The index to fungal names at the back of the book is very convenient if you are trying to locate entries of anamorphs, as the text is arranged by teleomorph names in alphabetical order. The literature cited provides a synopsis of the most important papers dealing with each of the genera, and in itself represents a valuable database for anyone initiating a study on any of these genera. Several genera were initially wrongly placed in the *Hypocreales* because of their characteristic fruit bodies. These genera, which are excluded in this study, were placed among 19 families of 12 orders of ascomycetes, and one basidiomycetous genus. These genera are briefly listed, discussed, and illustrated, and thus also represent an invaluable resource of data for those interested in revising any of these confused names.

Hypocrealean anamorph genera not yet linked to teleomorph genera are not dealt with. However, from this work it becomes evident that within the *Hypocreales*, taxonomists have been making a concerted effort to integrate sexual and asexual species, in many cases relying on various molecular data sets to do so. Many of the generic keys given rely chiefly on teleomorph characters to distinguish species. In some genera where the teleomorph is conserved, and species differences are expressed in the anamorph, it would have been better to rather include anamorph keys — the teleomorph also being rather rarely encountered by plant pathologists. In summary, I found the descriptions accurate and informative. The photo plates (black and white, as well as several amazing colour plates) and line drawings are breathtakingly beautiful. The authors, as well as CBS publications need to be congratulated for this truly exemplary piece of work. I am sure that it will inspire many mycologists, both young and old, for many years to come. It is truly wonderful to finally have such an excellent compilation of essential hypocrealean data. That said, this book also illustrates that there is ample scope for further work on this group of fungi. Owning this book, however, will make the task infinitely easier and more pleasurable. At the ridiculously low price of Hfl 95, it remains a bargain, whatever your currency!

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Proceedings of the Paul Heinemann Memorial Symposium: Systematics and Ecology of the Macromycetes. *Belgian Journal of Botany 131(2)*, 1998 (1999). Orders: Dr P. Compère, Jardin Botanique National, Domaine de Bouchout, B-1860 Meise, Belgium. Payments: Postal girocheque number 000-0075114-36 (Société Royale de Botanique de Belgique, B-1160 Brussels). ISSN 0037-9557. BeF 1800.

This Special Issue of the Journal constitutes proceedings of a symposium held in Meise, Belgium in 1997, in memory of the renowned Belgian mycologist, who left us in 1996 at the age of 80. The first part is an Homage to Prof. Paul Heinemann, a chronology of his life, listing his publications, his new taxa, taxa named after him, and his herbarium. Recognising that Paul Heinemann's interests, while rich and diversified, were aimed in particular at the family *Agaricaceae* and its tropical members, the next part deals with the systematics of African and other tropical fungi. Although Prof. Heinemann never visited the tropical countries himself, he had ample opportunity of examining and bringing into order the vast Belgian fungal herbarium with its legacy of species from colonial Africa, and from other parts of the world. The result is a long list of new species from these countries, especially in the genus *Agaricus*, which was always near to his heart. Apart from the mentioned topics, the second part presents papers on *Russula*, *Marasmius*, *Cantharellus*, *Polyporales*, and *Amanita*. The third part of the Journal consists of papers on European fungi. Also here the accent is on Paul Heinemann's influence on contemporary mycology, whether it is new taxa dedicated to him, studies of his own species, or treatments of groups within *Agaricaceae*. The fourth part deals with ecology and related subjects, mostly pertaining to European sites. The Special Issue ends with abstracts of remaining symposium papers and a list of participants.

The unique value of this issue lies in the pan-continental perspective within a relatively circumscribed group of fungi — *Agaricus*, *Lepiota*, and related genera. This makes it possible to compare taxa from widely separated geographical regions, comparisons that are frequently made in the papers. An interesting example is Roy Watling's paper on a new, monospecific genus in *Agaricaceae*, *Heinemannomyces* from the Malaysian region, which displays a unique new character — a lazuline-blue spore print. As we know, with a world-wide outlook it is possible to find virtually all colours within the family: brown, purple, red, green, and white spore-prints, but until now no taxon was published with this unique, blue tint. The author also explores all these affinities and, in the light of other important characters, concludes that the new species must be placed in a new genus, which quite naturally he names after the eminent *Agaricaceae* scientist. The only point of criticism one might raise against this highly interesting and pertinent issue is the poor use that has been made of colour illustrations (in fact there are only two).

Prof. Paul Heinemann was my mentor and friend during my years in Belgium and, like everybody else in the mycological community of that part of Europe, I came to admire and respect him for his precision, dedication, and profound knowledge — knowledge that he was always willing to share. I find it particularly fitting that a Special Issue is dedicated to his memory.

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The Editors express their appreciation to the following individuals who have, prior to acceptance for publication, reviewed one or more of the papers appearing in this volume.

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ERRATA

VOLUME SEVENTY-TWO

Page 555, line 15	for *A. S. Methuen*	read *A. S. Methven*

VOLUME SEVENTY-THREE

Page 4, line 15	for *species is*	read *species name is*
Page 116, line 2	for *diffes*	read *differs*
Page 118, line 2	for *Fée*	read *Fée.*
Page 149, line 7	for *genara*	read *genera*
Page 184, line 12	for *The*	read *the*
Page 188, line 15	for *Forma*	read *forma*
Page 190, line 14	for *antillorum*	read *antillarum*
Page 191, line 9	for *antillarum.,*	read *antillarum,*
Page 265, line 34	for *latin*	read *Latin*
Page 272, line 15	for *thikker*	read *thicker*
Page 337, line 22	for *differ*	read *differs*
Page 340, line 20	for *China. Which agree*	read *China, which agrees*
Page 340, line 23	for *have wide*	read *have a wide*
Page 340, line 24	for *tropic*	read *tropics*

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Bibliography of Systematic Mycology 10(6): xlviii-xlix. 1998.

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